TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH

A THESIS SUBMITTED TO

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT (PUNJAB)

IN THE PARTIAL FULFILLMENT

FOR THE AWARD OF DEGREE OF

MASTER OF SURGERY

IN

ORTHOPEDICS

MAY 2023

Submitted By

DR SAHIL SAHOTA

DEPARTMENT OF ORTHOPEDICS
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA, PUNJAB

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled "**TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH**" submitted towards partial fulfillment of the requirements for the award of **MS in ORTHOPEDICS** degree to BFUHS is a compilation of original work carried out by me under the supervision of Dr. Rajnish Garg, Professor & Head, Department of Orthopedics and Dr. Shekhar Singal, Associate Professor, Department of Orthopedics. No part of this thesis has formed the basis for the award of any degree previously.

_____

Dr. Sahil Sahota
Department of Orthopedics,
Dayanand Medical College & Hospital,
Ludhiana, Punjab

Date:

Place:

CERTIFICATE OF SUPERVISORS

This is to certify that the work incorporated in this thesis entitled "**TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH"** has been carried out by **Dr Sahil Sahota** under our direct supervision. The data incorporated in this thesis is original and genuine and has been carried out by the candidate himself.

Signature of Supervisor

Dr. Rajnish Garg
Professor & Head
Department of Orthopedics
DMC&H, Ludhiana

Signature of Co-Supervisor

Dr. Shekhar Singal
Associate Professor
Department of Orthopedics
DMC&H, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE INSTITUTE

This is to certify that the thesis entitled "**TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH"** is a bonafide research work done by **Dr Sahil Sahota** under the supervision of **Dr. Rajnish Garg**, Professor & Head, and **Dr. Shekhar Singal**, Associate Professor, Department of Orthopedics in this institution.

Principal

Dr. Sandeep Puri
Principal
DMC&H, Ludhiana

Date:

COPYRIGHT

Declaration by the Candidate

I hereby declare that the Baba Farid University of Heath Sciences, Faridkot, shall have the rights to preserve & use this thesis in print or electronic format for academic/study purpose by the research scholar/students.

Signature

Dr Sahil Sahota
Department of Orthopedics
Dayanand Medical College & Hospital,
Ludhiana, Punjab - 141001

Date:

© Baba Farid University of Health Sciences, Faridkot

Dedicated

to

my Grandparents

ACKNOWLEDGEMENT

First and foremost, I would like to thank ***The Lord Almighty*** *for his grace, for giving me the knowledge, ability and abundant blessings, in accomplishing the task and for keeping me sound and helping me in all ups and downs throughout my work.*

Words do not suffice to express my profound feeling of gratitude and indebtedness to my revered mentor and supervisor, ***Dr. Rajnish Garg****, Professor and Head of Department of Orthopedics, Dayanand Medical College and Hospital, Ludhiana. It is my proud privilege to have worked under the kind patronage and able guidance of such an eminent teacher, an Orthopedician par excellence, a person with unmatched clinical acumen, abound with infinite knowledge. His love, sustained encouragement, ardent personal interest and constructive criticism have always encouraged me to pursue my goal. He has been a fatherly figure, a treasure of wisdom and*

a source of perennial inspiration someone I'll look up to, throughout my life.

I am extremely thankful and grateful to my esteemed teacher and worthy co-supervisor; **Dr. Shekhar Singal,** *Associate Professor, Department of Orthopedics for helping me to form valid concepts of my study, invaluable guidance and encouragement throughout the course of this study.*

Words fail to express my profound pleasure and deep sense of gratitude to respected **Dr. Harpal Singh Selhi,** *Professor, Department of Orthopedics, DMC&H, Ludhiana, for their valuable suggestions, masterly guidance, and healthy criticism, which has brought this manuscript to see the light of day.*

I express my cordial thanks to **Dr. Deepak Jain, Dr. Pankaj Mahindra and Dr. Anubhav Sharma** *who have constantly supported me with their academic orientation and experience. Their guidance has been of profound help to me during my work.*

Mine is not a solitary journey for this noble venture. Words are inadequate to express my gratitude and appreciation for my dearest parents, ***Dr Gulzar Mohammad Sahota and Shehneela Parveen*** *for their unconditional love and unending blessings. I am very thankful to my father and mother in law,* ***Mr Mohammad Owais and Mrs Azra Owais*** *who always stood beside me through my tough times. Their affection, inspiration, constant encouragement and support have made me what I am today. I would like to thank my sister and brother in law,* ***Anam Gulzar and Mohammad Mauviz*** *for their constant support and encouragement.*

No words are enough to thank, ***Hadia****, my better half, who has been my driving force through the most difficult times. I owe her a lifelong gratitude.*

In Team Orthopedics, I am very grateful to my seniors ***Dr. Gobinder , Dr Amol Rattan, Dr. Sahil Singla , Dr Tushar Singla*** *who guided me through*

every hurdle. I would also like to thank my juniors ***Dr. Harshaan Pooni and Dr Shikhar Bindal*** *who always stood by my side for any help.*

I am also thankful to ***Mrs. Namita Bansal,*** *R&D DEPARTMENT for their help in the statistical work and* ***Mr. Sushil****, whose consummate interest in typesetting and passion for details has shaped this manuscript into a transcript.*

Dr. Sahil Sahota

LIST OF ABBREVIATIONS

CT	COMPUTED TOMOGRAPHY
AVN	AVASCULAR NECROSIS
AIP	ANTERIOR INTRA PELVIC
HHS	HARRIS HIP SCORE
MSA	MODIFIED STOPPAS APPROACH
IIA	ILIOINGUINAL APPROACH
ASIS	ANTERIOR SUPERIOR ILIAC SPINE
DVT	DEEP VEIN THROMBOSIS
VAS	VISUAL ANALOG SCALE

ABSTRACT

INTRODUCTION: Fractures of the acetabulum are relatively uncommon, but because they involve a major weight-bearing joint in the lower extremity, they attain great clinical importance. The two surgical approaches used for the anterior acetabulum fractures are anterior Ilioinguinal Approach and Stoppas approach. The present study was conducted to study the outcome of anterior acetabulum fractures using Stoppas and Ilioinguinal approach.

AIMS AND OBJECTIVES: To evaluate and compare stoppas and ilioinguinal approach in terms of anatomical reduction, complications and functional outcomes.

MATERIALS AND METHOD: A prospective and retrospective study was done to include 21 patients. They were admitted in Department of Orthopedics in Dayanand Medical College & Hospital, Ludhiana from January 2019 to January 2023 who had given informed consent to take part in the study. Data was collected by detailed history, obtained using study proforma with special attention to mechanism of injury, evaluations including base line clinical features; examination of other associated symptoms was based on history and physical examination.

RESULTS: Out of 21 patients, 16 were males and 5 were females. The mean age of the patients was 44.14±11.18 years. Out of our data pool 17 patients got admitted via road traffic accidents and in 4 patients the cause of injury was fall from the height. 5 patients (23.8%) presented with anterior column fracture while 6(28.6%) patients had anterior column + posterior hemi-transverse fracture while in 10(47.6%) the cause was associated both column fracture. Hip dislocation was present in 5(23.8%) of the patients. In 12 patients (57.1%) ilioinguinal approach was used while in 9(42.9%) stoppas approach was used. No significant difference was seen among both the groups regarding mode of injury ($p>0.05$). No significant difference was observed among both groups in respect to intraoperative, early and delayed post-operative complications. According to Merle d' Aubigne and Postel score, 66.7% patients had excellent outcome after 6 months which were operated using stoppas approach while 75%patients had excellent outcome after 6 months which were operated using ilioinguinal approach.

CONCLUSION: In present study we conclude that there is no significant difference between ilioinguinal and stoppas approach in terms of complications, blood loss, anatomical reduction, functional and radiological outcomes. The advantages of the Stoppas approach are that bilateral fractures can be treated with a single incision and better visualization of the quadrilateral plate is provided.

KEYWORDS: Acetabulum fracture, functional outcomes.

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-6
II	AIMS AND OBJECTIVES	7
III	REVIEW OF LITERATURE	8-29
IV	MATERIALS AND METHODS	30-33
V	OBSERVATIONS AND RESULTS	34-79
VI	DISCUSSION	80-91
VII	SUMMARY AND CONCLUSIONS	92-93
VIII	BIBLIOGRAPHY	94-99
	APPENDICES – I - PROFORMA - MASTER CHART	
	APPENDICES – II - APPROVAL LETTER OF THESIS PLAN - THESIS PLAN	

LIST OF TABLES

Table No.	Title	Page No.
1.	Distribution of patients according to age	34
2.	Distribution of patients according to gender	35
3.	Distribution of patients according to mode of injury	36
4.	Distribution of fracture according to the type of fracture [Letournel and Judet classification]	37
5.	Distribution of patients based on hip dislocation	38
6.	Distribution of patients according to site of fracture (laterality)	39
7.	Distribution of patients according to anaesthesia used	40
8.	Distribution of patients according to surgical approach used	41
9.	Distribution of patients according to blood loss	42
10.	Distribution of patients according to intraoperative complications	43
11.	Distribution of patients according to early postoperative complication (<72 hours)	44
12.	Distribution of patients according to delayed complications	45
13.	Comparison between age group and surgical approaches used	46
14.	Comparison between gender and surgical approaches used	47
15a.	Comparison between time of surgery and surgical approaches used	48
15b.	Comparison between time of surgery and surgical approaches used	48
16.	Comparison between grouped variables	50
17.	Comparison between fracture classification and surgical approaches used	50
18.	Comparison between hip dislocation and surgical	52

	approaches used	
19.	Comparison between laterality and surgical approaches used	54
20.	Comparison between mode of anaesthesia and surgical approaches used	56
21.	Comparison between blood loss and surgical approaches used	57
22.	Comparison between intraoperative complications and surgical approaches used	58
23.	Comparison between early postoperative complications and surgical approaches used	60
24.	Comparison between delayed complications and surgical approaches used	62
25.	Comparison between quality of reduction (MM) and surgical approaches used	64
26.	Comparison between fracture union and surgical approaches used	66
27.	Distribution of weight bearing and surgical approaches used	68
28.	Distribution of return to occupation and surgical approaches used	69
29.	Merle d' Aubigne and Postel Method score	70
30.	Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score	71
31.	Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score (grouped data)	72
32.	Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score	73
33.	Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score (grouped data)	74
34.	Distribution of patients according to ability to walk	75

	criteria according to Merle d' Aubigne and postel score	
35.	Distribution of patients according to ability to walk criteria according to Merle d' Aubigne and postel score (grouped data)	76
36.	Comparison between body movements and surgical approaches used (grouped data)	77
37.	Comparison according to Merle d' Aubigne and Postel SCORE	78

LIST OF FIGURES

Fig. No.	Title	Page No.
1.	Distribution of patients according to age	34
2.	Distribution of patients according to gender	35
3.	Distribution of patients according to mode of injury	36
4.	Distribution of fracture according to the type of fracture [Letournel and Judet classification]	37
5	Distribution of patients based on hip dislocation	38
6.	Distribution of patients according to site of fracture (laterality)	39
7.	Distribution of patients according to anaesthesia used	40
8.	Distribution of patients according to surgical approach used	41
9.	Distribution of patients according to blood loss	42
10.	Distribution of patients according to intraoperative complications	43
11.	Distribution of patients according to early postoperative complication (<72 hours)	44
12.	Distribution of patients according to delayed complications	45
13.	Comparison between age group and surgical approaches used	46
14.	Comparison between gender and surgical approaches used	47
15.	Comparison between time of surgery and surgical approaches used	49
16.	Comparison between fracture classification and surgical approaches used	51
17.	Comparison between hip dislocation and surgical approaches used	53
18.	Comparison between laterality and surgical approaches used	55
19.	Comparison between mode of anaesthesia and surgical approaches used	56
20.	Comparison between blood loss and surgical approaches used	57
21.	Comparison between intraoperative complications and	59

	surgical approaches used	
22.	Comparison between postoperative complications and surgical approaches used	61
23.	Comparison between delayed complications and surgical approaches used	63
24.	Comparison between quality of reduction (MM) and surgical approaches used	65
25.	Comparison between radiological findings and surgical approaches used	67
26.	Distribution of weight bearing and surgical approaches used	68
27.	Distribution of return to occupation and surgical approaches used	69
28.	Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score	72
29.	Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score	74
30.	Distribution of patients according to ability to walk criteria according to Merle d' Aubigne and postel score	76
31.	Comparison according to Merle d' Aubigne and Postel score	79

LIST OF PICTURES

Pic. No.	Title	Page No.
1.	The acetabulum is supported by the anterior (blue) and posterior columns. The dome of acetabulum lies in the concavity of the arch	9
2.	Judet and Letournel Elementary Fractures	10
3.	Letournel and Judet classification of Associated Fractures	10
4.	A. Ilioischial line, B. Iliopectineal line, C. Dome, D. Anterior wall, E. Teardrop, F. Posterior wall, G. Shenton's line	12
5.	Skin incision for ilioinguinal approach	15
6.	Structures dividing the 3 windows: iliac crest, lateral cutaneous nerve. of thigh, iliopsoas with femoral nerve, femoralvessels and spermatic cord from down upwards	15
7.	Anterior Ilioinguinal approach with its 3 windows after plating	16
8.	Skin incision for stoppas approach	17
9.	Corona mortis in stoppas approach	18

INTRODUCTION

Fractures of the acetabulum are relatively uncommon, but because they involve a major weight-bearing joint in the lower extremity, they attain great clinical importance.[1] Acetabular fractures are a challenging topic for radiologists and orthopedic surgeons. Fractures of acetabulum and pelvis constitute only 2% of all fractures but they are associated with significant morbidity and mortality due to associated injuries.[2] Injury to the acetabulum is almost always associated with soft tissues, neurovascular as well as abdominal viscera, urinary bladder and urethral injuries. The management of these injuries has become a sub-speciality within orthopaedics, and generally takes place in a tertiary referral setting.[3]

Before the introduction of the motorcars acetabular fractures were rare. Today the incidence of acetabular and pelvic fractures is approximately 1 in 50 000 population per year in the UK, and they represent 2% of all fractures. The incidence has decreased since the introduction of seatbelts. But overall has remained largely constant over most of the last 20 years.

Acetabular fractures are often high energy and therefore often present in combination with other organ injuries. These fractures have very high morbidity because the damage to the cartilage can lead to disabling osteoarthritis in the future.[4] The primary cause of acetabular fractures remains road traffic accidents, with a casualty rate between 40% and 76%. Other causes include falls, pedestrians hit by vehicles and less commonly sports injuries. Repeatedly, the most common fracture pattern seen is the associated both column fracture, followed by transverse, posterior wall, or a combination of both fractures. The hip dislocation rate is 15–40%.[3] There is bimodal distribution of acetabulum injuries. According to the largest study published (Giannoudis et al., 2005), the average age of patients is 39 years. Acetabular fractures primarily occur in young people who are involved in high-velocity trauma. Males are most commonly affected than females. 2 out of 3 cases are reported in which males are affected.[3] In

young population high energy trauma is the main cause of pelvic injuries whereas in age above 35, osteoporosis is one of the main causes of acetabular injuries.

BONE ANATOMY

Appreciation of the bony anatomy must not be restricted to the socket seen in total hip replacements but extended to include the anatomy of the whole innominate bone. The acetabulum itself is found where all the three pelvic bones that form the innominate bone meet, and in children, it is the site of the tri-radiate cartilage.

It is formed of

1. Anterior column
2. Posterior column
3. Anterior wall
4. Posterior wall
5. Medial wall
6. Acetabular dome

Radiographically, there are six important landmarks in anteroposterior views:

1. Iliopubic line
2. Ilioischial line
3. Teardrop sign
4. Sourcil
5. Anterior lip
6. Posterior lip

The anterior column is larger when seen from both inside and outside, but the bone of the posterior column is thicker and stronger, and includes very dense sciatic notch. In addition to this, fractures can involve the anterior or posterior walls, and may be above, through or below the acetabular dome.[3] The anterior column is composed of anterior half of iliac crest, iliac spines and anterior half of the acetabulum. The posterior column is made up of ischium , ischial spines and posterior half of the acetabulum.

The dome of the acetabulum is the weight bearing portion of the articular surface and supports the femoral head .The quadrilateral

surface is the flat plate of bone forming the lateral border of the true pelvic cavity and thus lying adjacent to the medial wall of the acetabulum .The acetabulum is evaluated radiographically with an anteroposterior pelvic (AP) view as well as 45 degrees oblique views[5, 6] referred to as judet views

SOFT TISSUE ANATOMY

The acetabulum is buried deep within the body. Access from any direction can be difficult. Anteriorly, it is crossed by the inguinal canal, with the femoral bundle and the ilio-psoas tendon beneath. At the lateral extent of the inguinal ligament lies the lateral femoral cutaneous nerve, which is at risk of injury in the ilio-inguinal approach. More laterally, the acetabulum is cloaked by the gluteal muscles, which extend posteriorly, covering the superior gluteal neurovascular bundle. The sciatic nerve is in close proximity as it emerges from within the pelvis via the greater sciatic notch, descending posterior to the hip joint. Medially to the acetabulum lies the obturator membrane.[3]

CLASSIFICATION

Letournel and judet is the commonly used classification for acetabular fractures .

The classification has 10 distinct categories which are divided into five elementary types and five associated types

Elementary (simple) patterns:

- Anterior wall fractures
- Anterior column fractures
- Transverse fractures
- Posterior column fractures
- Posterior wall fractures

Associated (complex) fractures:

- Both column fractures
- Anterior column / wall or posterior hemitransverse fractures
- T shaped fractures
- Transverse and posterior wall fractures
- Posterior column and posterior wall fractures[5, 6]

Diagnosis of an acetabular fracture is based primarily on plain X-rays, and the standard films are an AP pelvis and good quality Judet views. Except in emergencies it is now mandatory to have a CT scan of the pelvis. CT allows more precise imaging of the fracture pattern, as well as a clearer definition of fracture displacement.[3] The treatment of acetabular fracture is very complex topic. In the past, the non-operative treatment had been practiced. After the classic paper of Judet et al[5], in 1964, surgeon's understandings and concepts of treatment have changed. Currently, surgical treatment has evolved to be the treatment of choice.[7]

The result of the fixation is dependent on many variables such as extent of energy level of injury, radiographic fracture pattern, surgeons knowledge of pelvic anatomy, timing of surgery and appropriate choice of surgical approach[8,9] . The anatomical and radiographic classification plays an important role and timing of surgery is crucial as it may influence the outcome. Nowadays, although minimal invasive surgery has been popularized with the optimization of anatomic reduction and stability, the aim of the approach to be selected is to reduce morbidity.

Open reduction and internal fixation is the best treatment for displaced acetabular fractures from the current research reports. The operative approaches to the displaced acetabular fractures can be classified into two categories: extrapelvic approaches and intrapelvic approaches.[10] First described in 1961 by Letournel[6], the ilioinguinal approach is a typical extrapelvic approach which is used to treat anterior wall and column fractures. On the opposite, Stoppas approach is an intrapelvic approach, named after Rene Stoppas[11].

The two surgical approaches used for the anterior acetabulum fractures are:

1. Anterior ilioinguinal Approach – This approach was introduced by Emile Letournel in 1961.[6] Patient is placed on radiolucent operating table in supine position. Skin incision is made in midline 2 finger breadths above the symphysis pubis, extended to the anterior superior iliac spine (ASIS) and then continued posteriorly along the line of the iliac crest. The aponeurosis of the external oblique is incised in line

with the skin incision. An incision is carefully made along the inguinal ligament from its medial attachment on the pubis to the anterior superior iliac spine along its fibers. Three windows are created for visualization. The first window is formed by medial retraction of the iliopsoas and femoral nerves allowing visualization of the entire internal iliac fossa, the sacroiliac joint, and the pelvic brim. After mobilizing the Iliopsoas muscle, Iliopectineal fascia is palpated and its medial and lateral surfaces are defined before its division. Blunt dissection is continued below the vessels. The second window is created by lateral retraction of the Iliopsoas and femoral nerve, combined with medial retraction of the external iliac vessels and third window by lateral retraction of the vessels.

2. Stoppas approach: This approach was first introduced by Rene Stoppas in the year 1975.[11] The patient is positioned supine on a radiolucent table. A transverse incision is made approximately 2 cm above the symphysis. For the lateral window, an incision is made along the iliac crest, starting 2 cm posterior to the ASIS, following the iliac crest posteriorly. Subcutaneous tissue and rectus fascia are incised transversely. The pyrimidalis muscle is released and tagged for later repair. The rectus abdominus fascia is split along the linea alba. The transversalis fascia is opened superior to the pubic symphysis. This opens the potential space of retzius. For the lateral window, the insertion of the external oblique is released, permitting dissection into the internal iliac crest fossa (requires elevation of the iliacus muscle the origin of the rectus abdominus muscle is released off the posterior pubic rami but maintained anteriorly. A hohmann retractor is used to retract the rectus anteriorly. The iliopectineal fascia is released to enter the true pelvis. Anastamosis between the external iliac and obturator vessels (corona mortis) should be identified along the superior pubic ramus and ligated. The iliopsoas can now be subperiosteally elevated, and a retractor is used to retract the iliopsoas and external iliac vessels.

Given the specificity of reduction and fixation process, each approach has different advantages and disadvantages in treating displaced

acetabular fractures. Many case-controlled trials (CCTs) have been done to compare the outcomes and complications of the two approaches. But their clinical merits and drawbacks remain in controversy.[10,12]

Therefore the present study was conducted to study the outcome of anterior acetabulum fractures using Stoppas and Ilioinguinal approach.

AIMS AND OBJECTIVE

To evaluate and compare Stoppas and Ilioinguinal approach for anterior acetabulum fractures in terms of

- Anatomical reduction
- Complications
- Functional outcome

REVIEW OF LITERATURE

Acetabular fractures are a challenging topic for radiologists and orthopaedic surgeons.[13] These fractures are uncommon in comparison to other fractures – the average orthopaedic surgeon will never see a large or regular number of cases.[3] The management of these injuries has become a sub-speciality within orthopaedics, and generally takes place in a tertiary referral setting. While this process is relatively simple for isolated fracture cases, many patients also have other injuries, and management decisions then require communication amongst surgeons, different specialities and different hospitals. They achieve a great clinical importance because they involve a major weight-bearing joint in the lower extremity. Fractures of acetabulum and pelvis are associated with significant morbidity and mortality due to associated injuries.[14,15]

Acetabular fractures are often high energy and therefore often present in combination with other organ injuries. These fractures lead to damage of cartilage and have very high morbidity.[4] Young people are most commonly affected by acetabular fractures, occurring as a result of high energy injuries. Poor outcomes result in a significant burden on the patient and their support system for many years.[3]

The bony pelvis is composed of the sacrum, coccyx, and the two innominate bones. The innominate bones are formed by the fusion of the ilium, ischium, and pubis. The ilium makes the superior part of the acetabulum; the ischium, forms the posterior part of the acetabulum; and the pubis, forms the anterior part of the acetabulum. The pelvic bone form a ring, with the iliac bones that are articulating with the sacrum through the sacroiliac joints posteriorly and the two pubic bodies articulating at the pubic symphysis anteriorly. Along the lateral surface of each innominate bone lies the acetabulum, which articulates with the femoral head. A key reference point in the acetabulum is the cotyloid fossa—which is the central non articular aspect of the acetabulum below the acetabular roof.[13]

The acetabulum is a complex anatomical structure which is formed from 6 fundamental components:

1. Anterior column
2. Posterior column
3. Anterior wall
4. Posterior wall
5. Medial wall
6. Acetabular dome

Picture 1: The acetabulum is supported by the anterior (blue) and posterior columns. The dome of acetabulum lies in the concavity of the arch (Judet et al[5])

The anterior column is formed from a combination of the ilium and pubic bones. It extends from the posterosuperior ilium down along the pelvic brim to the pubic tubercle. Its width laterally extends to the ASIS. The underside of the anterior arch supports the anterior wall of the acetabulum.[5]

The most widely used classification of acetabular fractures is the Letournel classification, which is a modification of the 1964 Judet anatomic classification.

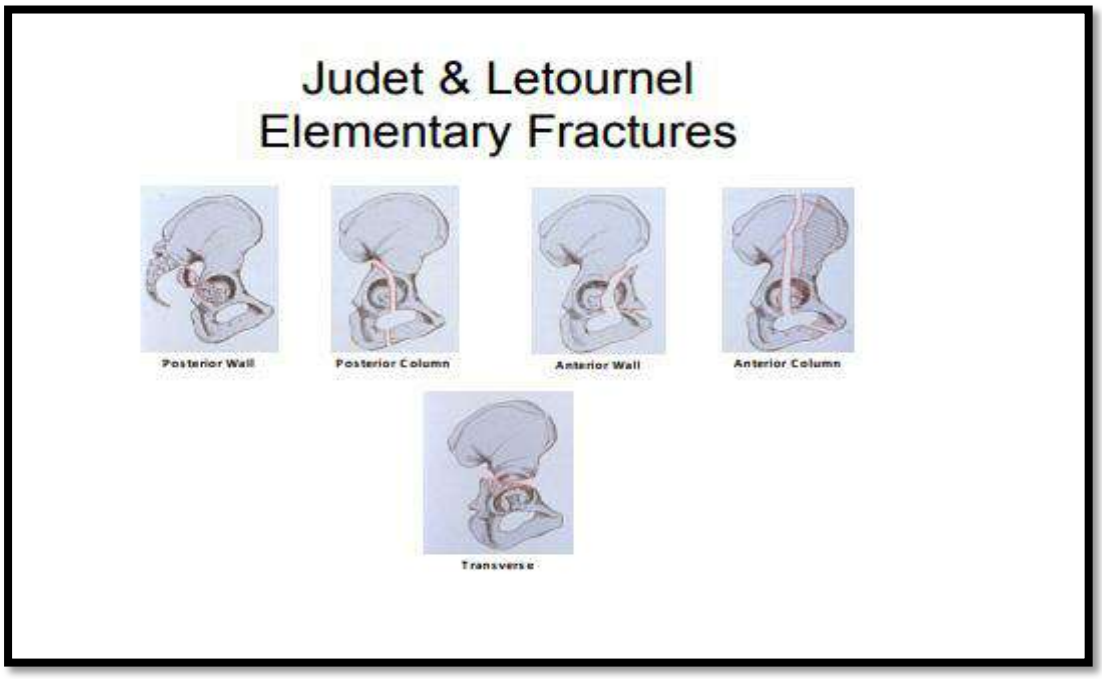
Letournel's system(1981) classifies acetabular fractures into 10 major fracture patterns, which consist of 5 simple patterns and 5 complex patterns.

The 5 simple patterns are the following:

1. posterior wall fractures (A)
2. posterior column fractures (B)
3. anterior wall fractures (C)

4. anterior column fractures (D)

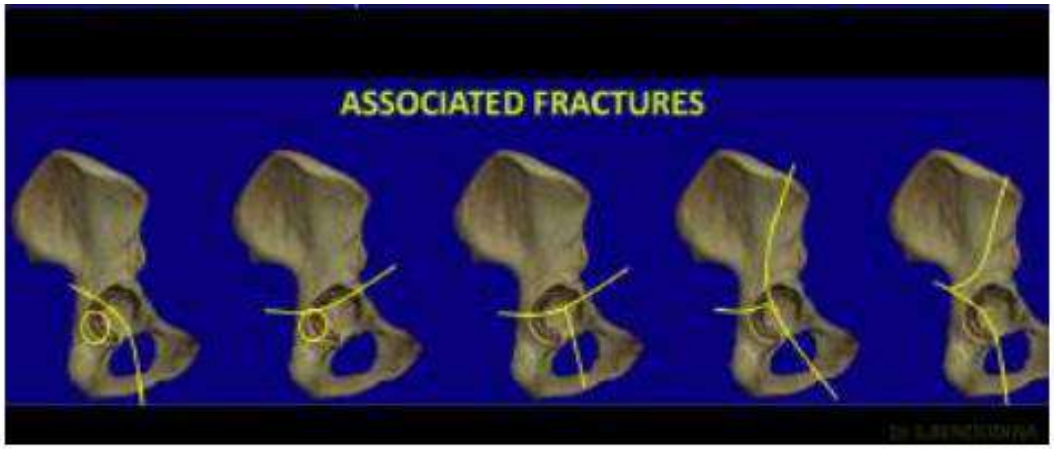
5. transverse acetabular fracture (E)



Picture 2: Judet and Letournel Elementary Fractures(Judet et al[5])

The 5 complex/associated patterns are combinations of the simple patterns:

- posterior column with a posterior wall fracture (F)
- transverse with a posterior wall fracture (G)
- T-type fracture (H)
- anterior column with a posterior hemi transverse (I)
- both column fracture



Picture 3: Letournel and Judet classification of Associated Fractures(Judet et al[5])

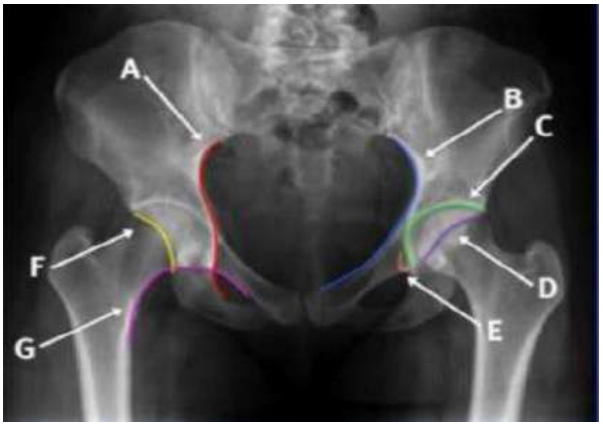
The anterior and posterior column fractures separate the entire column from the intact innominate while the anterior and posterior wall fractures separate only a portion of the column's articular surface. There is no anatomic dividing line at which the anterior column changes to the posterior column. Rather, column fractures are classified with respect to which portion of the innominate bone they separate from the intact portion of the ilium, not where in the ilium they occur.[16]

Anterior Column Fractures:

The anterior column fractures comprise of 3% to 5% of all acetabulum fractures. These fractures separate the anterior border of the innominate bone from the intact ilium. These are named by where the fracture exits the anterior aspect of the bone. All anterior column fractures, cross the pelvic brim, proceed down the quadrilateral surface, and enter the ischiopubic notch, ultimately ending in a fracture of the inferior ramus. The hallmark that distinguishes the very low anterior column fractures from the anterior wall fractures is the fracture of the inferior pubic ramus and the single break in the iliopectineal line. The femoral head displaces with the anterior column fracture. The typical displacement is an external rotation of the anterior fragment about the femoral head, allowing the head to move medial and cephelad.[16]

Radiographically, [17] six landmarks on the antero-posterior views are identifiable for description of the type of acetabular fractures:

1. Iliopubic line
2. Ilioischial line
3. Teardrop
4. Sourcil
5. Anterior lip
6. Posterior lip



Picture 4: A. Ilioischial line, B. Iliopectineal line, C. Dome, D. Anterior wall, E. Teardrop, F. Posterior wall, G. Shenton's line

Disruption of any of these radiographic landmarks suggests a fracture of the underlying structure. While the iliopubic line corresponds to the medial cortical border of the anterior column, the ilioischial line corresponds to the medial cortical border of the posterior column. The teardrop outlines an anterior portion of the quadrilateral plate medially, and an anteroinferior portion of the acetabular fossa laterally. This radiographic landmark identifies the position of the medial wall of the acetabulum. The Sourcil represents the superior most portion of the acetabular dome. The anterior and posterior lips represent the lateral most cortical border of the anterior and posterior acetabular walls. [17]

Diagnosis of an acetabular fracture is based primarily on plain X-rays, and the standard films are an AP pelvis and good quality Judet views. Except in emergencies it is now mandatory to have a CT scan. CT allows more precise imaging of the fracture pattern, as well as a clearer definition of fracture displacement.[3] The treatment of acetabular fracture is very complex topic. In the past, the non-operative treatment had been practiced.[5] Open reduction and internal fixation is the best treatment for displaced acetabular fractures from the current research reports. The operative approaches to the displaced acetabular fractures can be classified into two categories: extra pelvic approaches and intrapelvic approaches.[10]

A good approach is not only just providing good exposure but also allows anatomical reduction of fracture with a good control over the fracture fragments. A good approach causes least possible amount of

complications while trying to achieve the same.[12] The widely used technique for internal fixation of fractures of the pelvic ring and acetabulum is ilioinguinal approach. [6,12,18] Multiple studies have proven that it is very efficient in approaching anterior acetabular fractures. But it is a laborious exposure and there is an inherent danger to the neurovascular structures (external iliac vessels and femoral nerve) due to their proximity to the surgical plane.[19,20] In 1993, Hirvensalo, and later Cole described an extra peritoneal or "Stoppas" approach as an alternative approach for internal fixation of fractures of the pelvic ring or acetabulum.[21,22] Stoppas technique uses a single window to obtain an intra-pelvic overview of the operative field and keep the entire peritoneal sac and its contents, away from the fracture site with some added risk of vascular bleed from the corona mortis or the obturator vessels. [21,22]

The two surgical approaches used for the anterior acetabulum fractures are:

1. **Anterior ilioinguinal Approach –** This approach is described by Letournel in 1961.[6] This is the approach of choice for the exposure, reduction, and fixation of fractures involving the anterior column of the acetabulum and the inner surface of the innominate bone.[18,23-26] The opening of the inguinal canal and the mobilization of the external iliac vessels provide access to these structures through the ilioinguinal approach with the subsequent development of 3 "working windows. "The first or lateral window extends from the sacroiliac joint to the lateral aspect of the iliopsoas muscle, providing access to the sacroiliac joint, the internal iliac fossa, and the proximal pelvic brim. The second or middle window is defined laterally by the medial aspect of the iliopsoas muscle and the femoral nerve and medially by the external iliac artery, offering access to the distal pelvic brim, the quadrilateral surface, the anterior acetabular wall, the iliopsoas gutter, and the iliopectineal eminence. The third or medial window is developed between the external iliac vein and the lateral aspect of the rectus abdominis muscle, allowing access to the space of Retzius, the pubic symphysis, and the superior pubic ramus from the pubic tubercle to the

pectineus recess. Extensile maneuvers can offer broader exposure of the anterior wall, the anterior hip capsule, the quadrilateral surface, and the external iliac fossa.[27,28] . The advantages of this approach are less likely blood loos , imposing less danger to external iliac vessels .

Indications & Contraindications

Indications:

• Anterior wall acetabular fractures.

• Anterior column acetabular fractures.

• Transverse acetabular fractures with the major displacement occurring at the anterior column.

• Both-column acetabular fractures.

• Anterior element reduction and fixation in T-type acetabular fractures.

• Anterior column and posterior hemi transverse acetabular fractures.

• Anterior column and anterior wall acetabular fractures.

Contraindications

• Posterior wall acetabular fractures.

• Posterior column acetabular fractures.

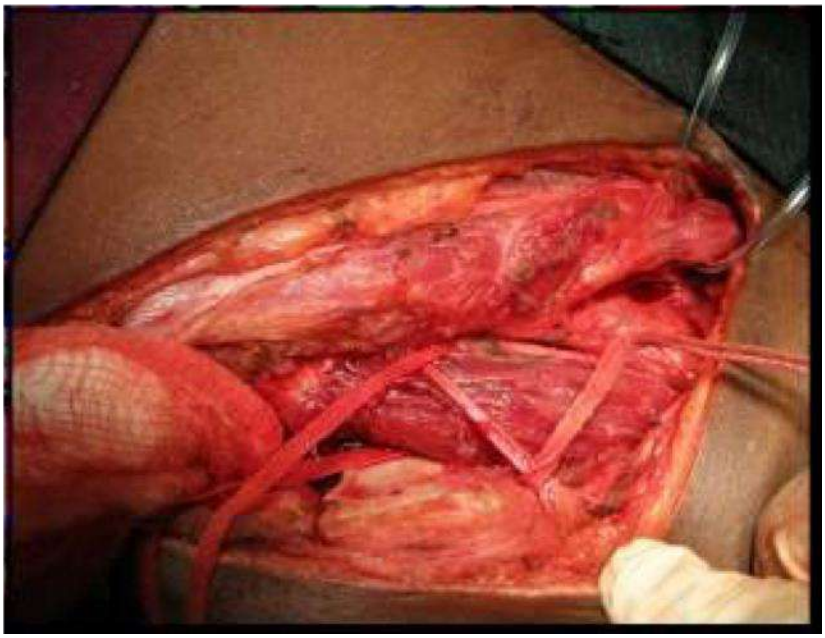
• Posterior column and posterior wall acetabular fractures.

• Transverse and posterior wall acetabular fractures.

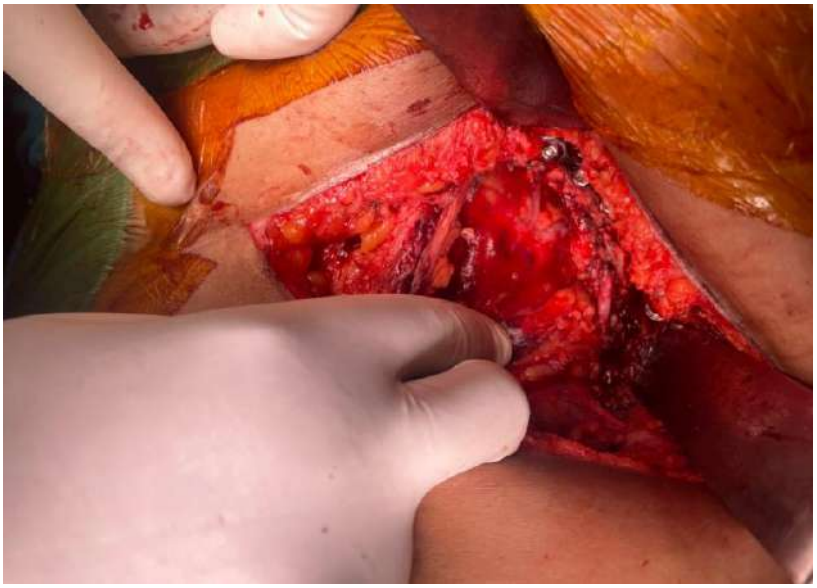
• Transverse acetabular fractures with the major displacement occurring at the posterior column.

• Posterior element reduction and fixation in T-type acetabular fractures.

Picture 5: Skin incision for ilioinguinal approach



Picture 6: Structures dividing the 3 windows: iliac crest, lateral cutaneous nerve. of thigh, iliopsoas with femoral nerve, femoralvessels and spermatic cord from down upwards.



Picture 7: Anterior Ilioinguinal approach with its 3 windows after plating

2. **Stoppas approach –** Stoppas approach has been used for treatment of inguinal hernias.[11,29-31] This approach was first described by Rene Stoppas in the year 1975. Hirvensalo et al in 1993 and Cole and Bolhofner in 1994 were the first who independently described intrapelvic extraperitoneal approaches for fixation of pelvic acetabulum fractures which was a modification of stoppas approach.[29] They reported that the Stoppas approach could expose the quadrilateral surface, the pelvic medial wall and even extend to the sacroiliac joint. Thus it could safely and effectively be used for the treatment of displaced acetabular fractures. [10] However, the rectus abdominis obstructs the surgical visualization and makes reduction and fixation at a further location. Moreover, anterior fracture with the iliac crest fracture must be accessed by an additional window of the ilioinguinal approach.[32] However, this midline approach does not provide enough close visualization for the fracture patterns with main anterior displacement and treating the fractures for anatomical reduction of the iliac wing[33].The advantages of this approach are less time consuming , better surgical exposure .

Indications & Contraindications

Indications:

• Anterior wall acetabular fractures.

• Anterior column acetabular fractures.

• Transverse acetabular fractures with the major displacement occurring at the anterior column.

• Both-column acetabular fractures.

• Anterior element reduction and fixation in T-type acetabular fractures.

• Anterior column and posterior hemi transverse acetabular fractures.

• Anterior column and anterior wall acetabular fractures.

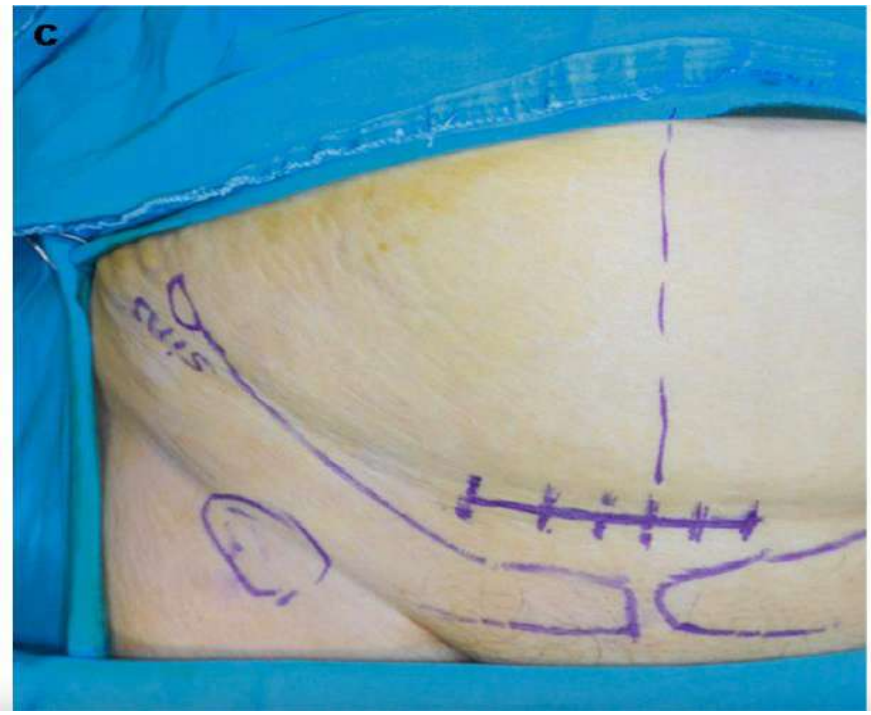
Contraindications

• Posterior wall acetabular fractures.

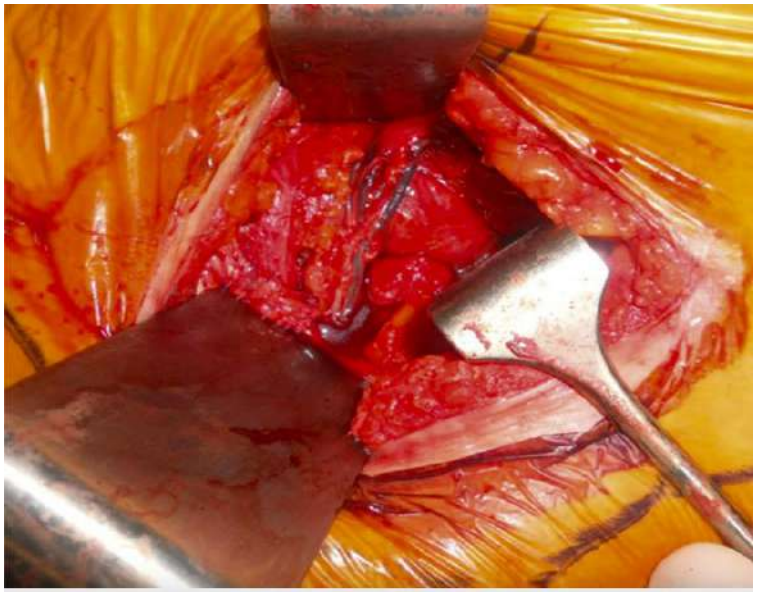
• Posterior column acetabular fractures.

• Posterior column and posterior wall acetabular fractures.

• Transverse and posterior wall acetabular fractures.



Picture 8 : Skin incision for stoppas approach(elmadag et al [38])



Picture 9: Corona mortis in stoppas approach (elmadag et al [38])

Taller S, Srám J, Lukás R, Krivohlavek M (2010)[34] The Stoppas method was utilized in the treatment of acetabular and pelvic ring fractures which allows a great visualisation of the anterior column, quadrilateral plate, and a portion of the posterior column for its precise reduction, as determined by analysis. Between April 2008 and September 2009, 14 patients had undergone 15 Stoppas approach procedures . This series consists of thirteen men and one woman with an average age of 47.7 years. In 11 patients, the mean duration of follow-up was 6.8 months (range: 3 to 15). In three patients, the post-operative duration was insufficient for assessment. The Harris hip score was utilized for clinical assessment. According to the criteria outlined by Matta and Pohlmann, radiographic results were evaluated. According to the findings of thestudy, ten patients had sustained an independent acetabular fracture, while two exhibited an acetabular fracture associated with pelvic ring injury. In one case, an isolated pelvic ring fracture was discovered. One patient suffered an acetabular and pelvic ring fracture on one side and a simple pelvic ring injury on the opposite side. In the remaining five instances, an isolated Stoppas strategy was employed. Ten patients had an exact anatomical or good repair of the acetabulum, while three individuals had a poor result with a 5-mm displacement. In two individuals, pelvic ring fractures were

anatomically decreased. The study revealed that the Stoppas approach provides excellent visualization of the anterior column and quadrilateral plate, as well as precise fracture reduction and stable fixation. In conjunction with other techniques, it provides anatomic restoration of the most severe acetabulum and pelvic ring fractures.

Rahimi H, Gharahdaghi M, Parsa A, Assadian M (2013)[2] reported the 15-year results (1996-2010) and functional outcome of surgical treatment of various forms of displaced acetabular fractures were presented. The authors reported 67 consecutive patients who had undergone acetabulum fixation . In 35 cases (79.5%), similar reductions were achieved. The ultimate mean score for the Harris hip was 81.8 (53-95). The Harris score indicated that the functional outcomes of 31 patients (70.5%) were excellent or good. The results of internal fixation of displaced acetabular fractures in this series were satisfactory, according to the study.

Bastian JD, Tannast M, Siebenrock KA, Keel MJB (2013)[35] evaluated the midterm outcome of acetabular fractures involving the anterior column that were treated with the modified Stoppas technique, with a focus on age and the aforementioned fracture characteristics: Between October 2005 and April 2009, 59 patients (mean age 57 years, range 13–91) with anterior column fractures were treated utilizing the modified Stoppas technique alone or in conjunction with the 1st window of the ilioinguinal approach or the modified Smith-Petersen approach, respectively. Surgical data, accuracy of reduction, clinical and radiographic outcome at mid-term, and the need for endo prosthetic replacement in the postoperative course (defined as failure) were evaluated. Univariate and multivariate regression analyses were performed to identify independent predictive factors (e.g., age, non anatomical reduction, acetabular roof impaction, central dislocation, quadrilateral plate displacement) for a failure. Patients were divided into two groups based on their age (group "<60 yrs", group "60 yrs") for the purpose of assessing their outcomes in accordance with their ages. In the presence of acetabular roof impaction, a statistically significant

increase in the rate of non anatomical decrease was detected (p = 0.04). 16% of all patients underwent total hip replacement, and 69% of patients with intact hips had excellent or satisfactory clinical outcomes at a mean follow-up of 35± 10 months (range: 24–55). There were no statistically significant differences between the two groups. The study concluded that non anatomical repair of the articular surfaces is associated with failure of joint-preserving therapy of acetabular fractures using an independent or combination modified Stoppas method, leading in mid-term total joint replacement. In the elderly, joint-preserving surgery is worth investigating since promising clinical and radiological results might be obtained at mid-term.

Liu Y, Yang H, Li X, Yang SH, Lin JH (2013)[33] Patients with acetabular fractures were evaluated utilizing a newly modified Stoppas method in conjunction with a lateral approach to the iliac crest in terms of fracture reduction and fixation, technical features, and the incidence of comorbidities. Between 2009 and 2011, a cohort of 29 consecutive adult patients with acetabular fractures was treated surgically with Stoppas approach . To repair the acetabular fractures with major anterior displacement and the anterior and lateral portions of the pelvis, a newly modified Stoppas technique was utilized. For iliac wing fractures, this method was paired with a lateral approach on the iliac crest. All patients were observed for a minimum of 1.5 years, according to the findings. Ten anterior columns, two associated both columns, seven anterior columns with posterior hemi-transverse, four transverse, and six T-type fractures were observed in the 29 patients. The average blood loss was 950 mL, and the average length of the procedure was 155 minutes. In 96% of the acetabular fractures, anatomic or acceptable reduction was achieved. Within three months, two patients with modest lateral femoral cutaneous nerve complaints improved. The conclusion of the study was that Stoppas method offered excellent vision of the anterior column and quadrilateral surface and facilitates satisfactory postoperative outcomes for the treatment of acetabular fractures. The authors viewed this method as a suitable alternative to

the ilioinguinal approach when anterior acetabulum exposure is required.

Ma K, Luan F, Wang X, Ao Y, Liang Y, Fang Y et al (2013)[36] compared the outcomes of the modified Stoppas approach and the ilioinguinal approach to discover which approach was superior for the treatment of acetabular fractures. Sixty consecutive patients with acetabular fractures were randomized to receive either the modified Stoppas or the ilioinguinal approach . Preoperative parameters included fracture pattern, associated injuries, time to surgery, and Injury Severity Score; intraoperative parameters included blood loss and operative time for each procedure; and postoperative parameters included wound drainage, blood transfusion, perioperative complications, early operative complications, late operative complications, quality of reduction, radiological results, and clinical results. All preoperative characteristics examined in the study indicated no significant differences between the two groups (all P>.05) In addition, the intraoperative complication rate, early operative complication rate, late operative complication rate, quality of reduction, radiological results, and clinical outcomes did not differ significantly (all P>.05). In contrast to the ilioinguinal approach , the modified Stoppas approach lowered intraoperative blood loss, wound drainage, and the need for blood transfusion, and decreased surgical time (all P<.05). When anterior exposure of the acetabulum is required, the authors suggested adopting the modified Stoppas approach rather than the standard ilioinguinal approach to treat acetabular fractures.

Anizar-Faizi A, Hisam A, Sudhagar KP, Moganadass M, Suresh C (2014)[7] Assessed the efficacy of surgical therapy for displaced acetabular fractures at regional hospitals. Thirty patients with acetabular fractures who underwent open reduction and internal fixation were included in a retrospective analysis. The data was collected over a four-year span, from 2008 to 2011. The results indicated that twenty of thirty patients (66.7%) had excellent/good outcomes (Harris Hip Score equal or more than 80). Deep infection (6.7%), iatrogenic sciatic nerve injury (10%), avascular necrosis

(16.7%), heterotopic ossificans (3.3%), degenerative alterations in hip joint (43.3%), and loss of reduction (3.3%) were postoperative complications .

Shazar N et al (2014)[37] Compared the reduction quality, surgical time, and early postoperative problems between the Ilioinguinal and Anterior Intra Pelvic approach . In a retrospective research, 122 patients operated on between 1996 and 2003 using the ilioinguinal approach were compared to 103 patients operated on using the AIP technique between 2004 and 2011. The demographics, fracture type, quality of fracture reduction, surgical time, and postoperative complications of the patients were compared. Anatomic reduction was accomplished in 84 patients (68.9%) treated with the ilioinguinal approach and 85 patients (82.5%) treated with the AIP technique (P = 0.018). In both columns, anatomic reduction of acetabular fracture type was achieved in 54.2% of the ilioinguinal group and 79.4% of the AIP group (P = 0.018). In the ilioinguinal group, surgery time decreased as the number of procedures rose (P = 0.021), however the AIP group did not exhibit a comparable trend. The distribution of fracture types and rates of complications were comparable between the two groups. The authors concluded that the AIP approach is a safe alternative that provides greater exposure and maybe enhanced reduction quality for acetabular fractures when compared to the ilioinguinal approach.

Elmadağ M, Y. Güzel, M.A. Acar, G. Uzer, M. Arazi (2014)[38] in the treatment of anterior column acetabulum fractures, the modified Stoppas method is hypothesized to result in less blood loss than the ilioinguinal approach. Retrospective analysis was performed on 19 patients treated with the ilioinguinal approach (Group A) at a mean follow-up of 33 months and 17 patients treated with the modified Stoppas approach (Group B) at a mean follow-up of 28.9 months. Patients were summoned to the final follow-up assessment, mean follow-up durations were determined, and patients' functional status was assessed by measuring their range of motion, Harris Hip Scores (HHS), and Merle D'Aubigné score. The present study determined that the average blood loss in Group A was 1170 mL (range, 750–2150 mL)

and in Group B, it was 1110 mL (range, 450–2000 mL) (P = 0.168). The mean HHS scores (group A= 89.4 [73–99] and group B = 88.4 [75–97]) and Merle D'Aubigné scores (group A= 16.8 [13–18] and group B = 16.5 [13–18]) did not differ significantly across groups (P = 0.169). At the final follow-up, the mean hip flexion was 106.83± 12.47 and the mean hip extension was 10.33± 6.12 in Group A, whereas these values were 103.71± 14.32 and 10.69± 8.17 in Group B (P = 0.678 and p=0.445 for flexion and extension, respectively). 31% of Group A (6 patients) and 23% of Group B (4 patients) experienced complications (P > 0.05). The authors found that both surgical techniques for treating acetabular fractures are effective. Even though the Stoppas technique is less invasive, there was no change in the volume of bleeding at the wound site as compared to the ilioinguinal approach.

Wang XJ et al (2016)[10] compared the efficacy and safety of open reduction and internal fixation using ilioinguinal and Stoppas approaches for the treatment of displaced acetabular fractures. Cochrane Library, Pubmed, CNKI, and other databases were searched for case-controlled trials (CCTs) published between January 2010 and August 2015 that compared the ilioinguinal approach and Stoppas technique for the management of displaced acetabular fractures. Comparing the efficacy and safety of the ilioinguinal and Stoppas approaches for the treatment of displaced acetabular fracture yielded statistically significant differences in the average operation time and the median intraoperative blood loss. The fracture end reset satisfaction rate, early complications rate, late complications rate, and Harris hip score excellent function rate were not statistically significant. Although both approaches can achieve excellent clinical functions in the treatment of displaced acetabular fractures, the Stoppas approach is preferable to the ilioinguinal approach in terms of operation duration and intraoperative blood loss, according to the findings of the study.

Meena S, Sharma PK, Mittal S, Sharma J, Chowdhury B (2017)[12] contrasted the effectiveness of the modified stoppas technique to the ilioinguinal approach in the management of acetabular fractures in

terms of a) quality of reduction achieved, b) complication rates, c) functional outcomes, d) operating time, and e) intra-operative blood loss. Among these 375 patients, 192 were treated using ilioinguinal approach and 183 via modified Stoppas approach. Results indicated that anatomical reduction was considerably greater in the Stoppas group (p = 0.052, RR = 1.19 (1.02, 1.37) p = 0.90, I2 = 0%). The incidence of complications was substantially higher with the Ilioinguinal method than with the Stoppas procedure (p=0.01, RR 0.63 (0.44 to 0.91)), p=0.73 (I2 = 0%), and p=0.01. There were no statistically significant differences between the two groups in terms of functional results and blood loss. Compared to the ilioinguinal technique, anterior acetabular fractures treated with the modified Stoppas approach were reported to have better reduction, reduced complication rates, and shorter operative times. There was no significant difference in blood loss between the two groups.

Kilinc CY et al (2018)[39] analysed the clinical and radiographic outcomes of surgical treatment for acetabular fractures using a modified Stoppas method. The study comprised 57 patients (mean age: 37.8 years; age range: 15-84) who had surgical treatment for acetabular fracture using a modified Stoppas technique between February 2013 and June 2016. The mean duration of follow-up was 28.1 months (range 24-35). Fracture patterns, time to surgery, operational time, blood loss, reduction quality, and perioperative complications were examined in the medical records. For functional evaluation, the Harris Hip Score (HHS) and Merle d'Aubigne score were utilized. All surgeries were conducted by a single surgeon. In the first 19 cases, a Pfannenstiel incision was utilized, while the following 38 cases utilized a vertical midline incision. The average blood loss was 660 mL, and the duration of the procedure was 152 minutes. Clinical outcomes at 2 years with HHS and were- mean 86.6 (range 66-96) (Excellent in 27, good in 23, fair in 4, bad in 3 patients) and Merle d'Aubigne score – mean 16.7 (range 10-18) (Excellent in 25, very good in 18, good in 6, fair in 5, poor in 3 patients). There was a substantial correlation between reduction quality and clinical outcome (p< 0.001),

while there was no correlation between fracture type and clinical outcome ($p > 0.05$). Two individuals demonstrated iatrogenic external iliac vein injury. Three patients exhibited obturator nerve palsy and recovered spontaneously after a mean of 3.7 months (range 3-5). Two of the 19 (10.5%) Pfannenstiel- incision patients experienced paralysis of the rectus abdominus, although none of the vertical- incision patients did. Even in bilateral fractures with a vertical midline incision, the study indicated that satisfactory outcomes are possible.

Halwai MA, Manzoor QW, Wani MI, Mir BA (2019)[40] investigated the incidence and injury patterns of acetabular fractures in a tertiary care hospital in northern India. Prospective data collection of patients hospitalised for acetabular fractures between June 2015 and December 2017 was conducted. The ages, genders, fracture side, mechanism of injury, fracture patterns, complications of surgery, and concomitant fractures of the patients were recorded. 55% (33) of these patients presented with a fracture of the left acetabulum, while 45% (27 patients) presented with a fracture of the right acetabulum, as determined by the present study. 45% (27 patients) of instances were automobile accidents, followed by motorcycle accidents (30%; 18 patients) and fall from height (10%; 6 patients). According to the Letournel classification, anterior fractures were the most common. Anterior Column with posterior hemi-transverse fractures (31.67 %; 19 patiets), followed by posterior wall fractures (20 %; 12 patients) and transverse fractures (18.33 %; 11 patients). The authors of this study determined that the left side was more affected than the right. Automobile accidents were the mechanism of injury that generated this type of fracture most frequently. The most frequent damage pattern was anterior column with posterior hemi transverse. Sciatic nerve injuries were the most prevalent surgical complication.

Kadam R, Dagar PS, Challani A, Jadhav A , Pestonji J (2019)[41] analysed the clinical and functional result of acetabular fractures treated with the Modified Stoppas technique. In addition, the authors analysed intraoperative and postoperative consequences of fractures

treated with the modified Stoppas technique. All 20 patients who required the anterior approach for acetabular fracture therapy between May 2016 and May 2018 underwent surgery using a modified Stoppas method. The fracture was classified with an anterior-posterior (AP) image, Judet, and CT scan prior to surgery. The functional outcome was evaluated using a modified Merle D' Aubigne scale. The Postel clinical grading system, Matta et al's radiological result, and perioperative complication were evaluated by examining medical records and radiographs retrospectively. The clinical outcomes were outstanding in 12 cases, very good in 2 cases, acceptable in 1, mediocre in 1, and poor in 4. Despite the fact that 12 instances showed anatomical reduction, 5 cases had imperfect reduction and 3 cases had poor reduction. The conclusion of the study was that the modified Stoppas method might be utilized as an alternative to the ilioinguinal method. It offers superior access and visibility to the anterior column and quadrilateral surface, and the incidence of complications was lower than with the ilioinguinal approach.

Yao S, Chen K, Ji Y et al (2019)[32] compared the efficacy of the operational procedures, complications, reduction quality, and hip functional recovery between the modified Stoppas approach and the supra-ilioinguinal approach for the treatment of acetabular fractures. Sixty consecutive patients with displaced acetabular fractures involving the quadrilateral plate were treated operatively using the supra-ilioinguinal approach (group A) and the modified Stoppas method (group B), respectively, from September 2014 to October 2017. 36 patients comprised group A, whereas 24 patients comprised group B. The surgical specifics, complications, radiological findings, and clinical outcomes were documented. The quality of reduction was evaluated by evaluating the residual step and gap displacement of postoperative CT using a digitally standardized approach. Complications, reduction quality (gaps and steps), and hip function recovery did not differ significantly across both the groups , according to the findings of this study. Group A had a shorter mean operative time and a lower mean

intraoperative haemorrhage. There were statistically significant differences between the supra-ilioinguinal and modified Stoppas approaches in terms of surgical time (P = 0.025) and intraoperative bleeding (P = 0.003). Compared to the modified Stoppas method, the supra-ilioinguinal approach provides a clearer view of the quadrilateral plate, a shorter operational duration, and significantly less intraoperative bleeding, according to the study. It is at least equivalent to or may be a superior option for treating complex acetabular fractures, particularly those involving the quadrilateral plate and the anterior one-third of the iliac bone.

Wu H, Zhang L, Guo X, Jiang X (2019)[42] compared the effectiveness of the modified Stoppas method (MSA) versus the ilioinguinal approach (IA) for treating anterior pelvic ring and acetabular fractures. Operative time, intraoperative blood loss, reduction quality, clinical outcome, and complications were among the retrieved data. This meta-analysis includes five publications, with 186 patients in the MSA group and 219 in the IA group. MSA significantly decreased operating duration (P=.0002), intraoperative blood loss (P=.002), and reduction quality (P=.03) as compared to IA. In contrast, this meta-analysis indicates that there are no significant differences between MSA and IA in terms of clinical outcomes (P=.63) and complications (P=.34). Additionally, the subgroup analysis of complications revealed no statistically significant difference between the two groups (including infection, and vascular and nerve injuries). In conclusion, the existing evidence demonstrates that MSA can dramatically minimize surgical time, reduce intraoperative blood loss, and give superior reduction quality compared to IA in the treatment of anterior pelvic ring and acetabular fractures. In terms of clinical outcomes and complications, there were no significant differences between the two groups.

Al Adawy AS et al (2020)[43] contrasted the operating method, clinical results, and complications of the Stoppas approach to the classical ilioinguinal approach in terms of fracture comminution. A randomized,

controlled clinical research was done to provide an update on our experience with modified Stoppas approach as an advantageous surgical technique for acetabular fractures. In the period 2015-2017, the medical records of 18 patients with acetabular fractures treated with the classical ilioinguinal approach served as the control group, while 20 patients with acetabular fractures treated with the modified Stoppas approach served as the clinical case group in the period 2017-2019. In terms of operation and postoperative clinical data, complications, and follow-up, the two groups were compared. The same surgeon and one of the co-authors performed surgical procedures at Al Zahraa University Hospital and Nasr City Insurance Hospital. The results indicated that (Group A) those operated using an ilioinguinal approach and (Group B) those operated using a Stoppas approach . The total sample consisted of 25 males (66%), with a mean age of 41.8± 8.42 (range: 18-65) years. The mean time of follow-up was 18.5 months, and 5 patients were lost to follow-up. Both column fractures were found in the majority of patients (45%). They saw better anatomical reduction , high clinical outcome scores, and less problems in 75% of group B patients (p = 0.030). The results of the t study indicated that the modified Stoppas approach is the most practical surgical method for the treatment of anterior acetabular fractures, as it improves visualization in lateral compression injuries and permits treatment of both column fractures through a single incision.

Aziz AMA, Sonkawade VD, Santpure S (2020)[44] The purpose of this study was to compare the pros and cons of the modified Stoppas approach (MSA) and the ilioinguinal approach (IIA) for surgery of pelvic acetabular fractures involving anterior column, anterior wall, quadrilateral plate with protrusion and complex fractures, pelvic ring fractures with pubic diastasis or sacroiliac joint disruptions that require anterior stabilization. Between June 2018 and March 2020, the Department of Orthopaedics at the Government Medical College and Hospital in Aurangabad examined individuals with pelviacetabular

fractures. In the study of 25 patients, they were classified into two groups, A and B. Group A consisted of 13 patients who underwent surgery by MSA, whereas Group B comprised 12 patients who underwent surgery by IIA . The duration of follow-up was 12-18 months (mean=15) for group A and 12-16 months (mean=14) for group B. Patients were evaluated using the modified Merle d'Aubigné score and the Matta's score. The results revealed that the mean modified Merle d'Aubigné score for groups A and B was 16 and 14, respectively (p=0.89). In MSA, mean blood loss and operative time were less as compared to ilioinguinal approach . One patient in each of groups A and B had a superficial infection, but one patient in group B acquired a deep infection. One patient in each group exhibited hip pain indicative of early arthrosis. Two patients in group B had meralgia paresthetica. In group B, one patient suffered external iliac artery thrombosis and an inguinal hernia, while in group A, one patient acquired an incisional hernia. The study concluded that MSA was superior to IIA with enough training and practice to establish direct access for pelviacetabular fracture reduction, as well as requiring less operational time, less blood loss, and a superior postoperative outcome.

MATERIALS AND METHOD

SOURCE OF DATA

Patients included in the study were admitted in Department of Orthopedics in Dayanand Medical College & Hospital, Ludhiana from January 2019 to January 2023 who had given informed consent to take part in the study

METHOD OF COLLECTION OF DATA

A. Methodology and type of data collected:

After obtaining clearance and approval from the institutional ethical committee, patients fulfilling the inclusion / exclusion criteria were included in the study after obtaining informed consent. Detailed history was obtained using study proforma with special attention to mechanism of injury, evaluations including base line clinical features, examination of other associated symptoms was based on history and physical examination. Collection of data of patients presenting with anterior column fracture of acetabulum are as follows.

- History.
- Clinical examination both systemic and local.
- Radiological examination using x-ray, CT (computerized tomography)
- Scan and other imaging modalities if necessary.
- Investigations – routine and others.
- Diagnosis- clinical and radiological.
- Surgery- open reduction and internal fixation of anterior column fracture of Acetabulum.
- Routine antibiotics and analgesics/anti-inflammatory drugs.
- DVT prophylaxis
- Postoperative evaluation by clinical examination and x ray pelvis (AP View, iliac oblique view, obturator oblique view)
- Surgical approaches:

- Ilioinguinal approach
- Stoppas approach

Assessment of complications.

• Perioperative – hypotension, shock, haemorrhage, nerve injury, vascular injury, inability to reduce the hip.

• Immediate Post-operative –acute renal failure (ARF), pulmonary embolism, fat embolism, cardiovascular compromise , infection, loss of reduction, DVT

• Late Post-operative -infection, non-union, malunion, failed fixation, osteoarthritis of hip joint, avascular necrosis of the femoral head, dislocation of femoral head, metal work failure

Clinical follow-up was done at 4 weeks, 3 months, 6 months intervals to assess the pain, healing of fracture, and functional status of the hip.

Radiological follow up by X ray was done at 4 weeks, 3 months, 6months, to assess the reduction and healing status of the hip.

Inclusion criteria:

1. Anterior column fractures of acetabulum
2. Age group >18 years of either gender.
3. Patients who give informed consent and willing for follow up.

Exclusion criteria:

1. Patients less than 18 years of age.
2. Patients unfit for surgery.
3. Pregnant patients
4. Open fractures
5. Pathological fractures
6. Patients managed conservatively
7. Patients managed with hip replacement

Study design: prospective & retrospective

Study duration: 3 years

Place of study: In patients in Department of Orthopaedics in Dayanand Medical College & Hospital, Ludhiana.

Pre- operative regimen:

A detailed history was taken from the patient presenting to the hospital Emergency department. Assessment of airway. Breathing and Circulation was done first and managed accordingly. Patient underwent complete physical examination to evaluate the extent of injuries and

neurovascular status. Analgesics, blood products and i/v fluids were administered as per requirement. Patient was resuscitated and routine investigations and radiographs were done. Any co-existing comorbidities such as diabetes mellitus, smoking, hypertension etc. were evaluated accordingly. Pre anaesthetic consultation was taken and the patient was planned for surgery when fit.

Post- operative regimen:

Post-operative x-rays were done to check the reduction and fixation of fracture. Skeletal/skin traction was applied if deemed necessary by the operating surgeon. Patient underwent appropriate physiotherapy as tolerated. I/v antibiotics and analgesics were continued as per Protocol. Appropriate DVT prophylaxis was given. After discharge from the hospital, the patient was called for regular follow up for dressing and repeat radiographs and for assessing the functional status of hip. weight bearing was allowed according to the radiological and clinical results. The patients were analysed for complications such as infection, limb shortening, deformity at the joint, implant failure, non-union, delayed union, post traumatic arthritis, heterotopic ossification etc

NO OF CASES – Cases gathered in the given time period of thesis study.

OUTCOME - The stoppas and the Ilioinguinal approach were compared in terms of anatomical reduction , complications and functional outcomes and conclusion were made regarding which of the following two surgical approaches was better .

STATISTICAL ANALYSIS –

Data was described in terms of range, mean and standard deviation (+-SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Mann Whitney U test. For comparing categorical data, Chi square (x2) test was performed and exact test was used when the expected frequency is less than 5. A probability value (p value) less then 0.05 was considered statistically

significant. All statistical calculations were done using (Statistical Package for the Social Sciences)SPSS 21version(SPSS Inc.,Chicago ,IL,USA) statistical program for Microsoft Windows

OBSERVATIONS AND RESULTS

Table 1: Distribution of patients according to age

AGE GROUP	No. of cases	Percentage
< 35	6	28.6%
35-45	5	23.8%
45-55	7	33.3%
> 55	3	14.3%
Total	21	100.0%

Table 1 shows: Out of 21 patients in our study , the age ranged widely from 24 years to 65 years. The mean age of the patient was 44.14±11.18 years.

Figure 1: Distribution of patients according to age

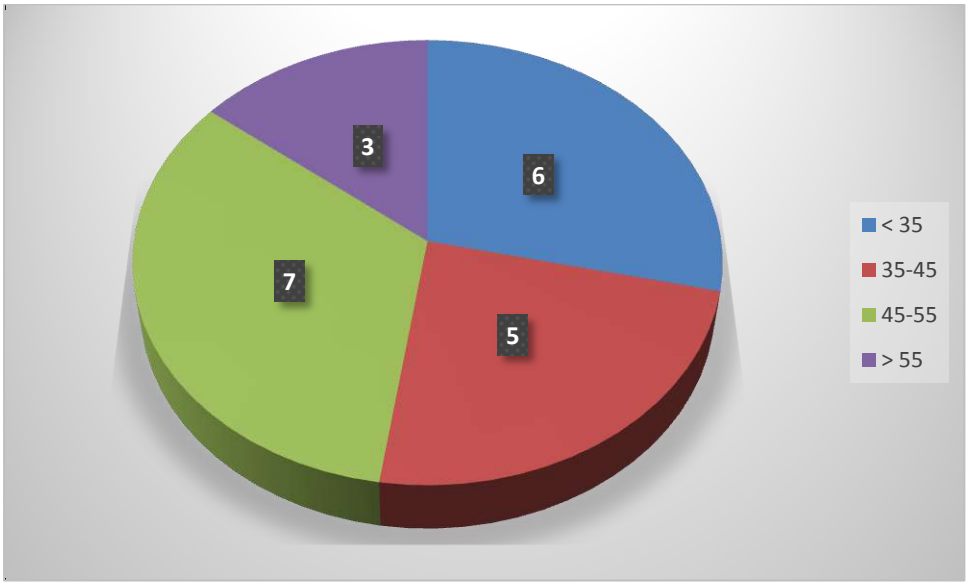


Table 2: Distribution of patients according to gender

GENDER	No. of cases	Percentage
Female	5	23.8%
Male	16	76.2%
Total	21	100.0%

Out of 21 patients included in our study , 16 patients (76.2%) were male and 5 patients (23.8%) were females with a Male to Female ratio of 3:1 Therefore , there has been a higher incidence of acetabulum fractures among males in our study.

Figure 2: Distribution of patients according to gender

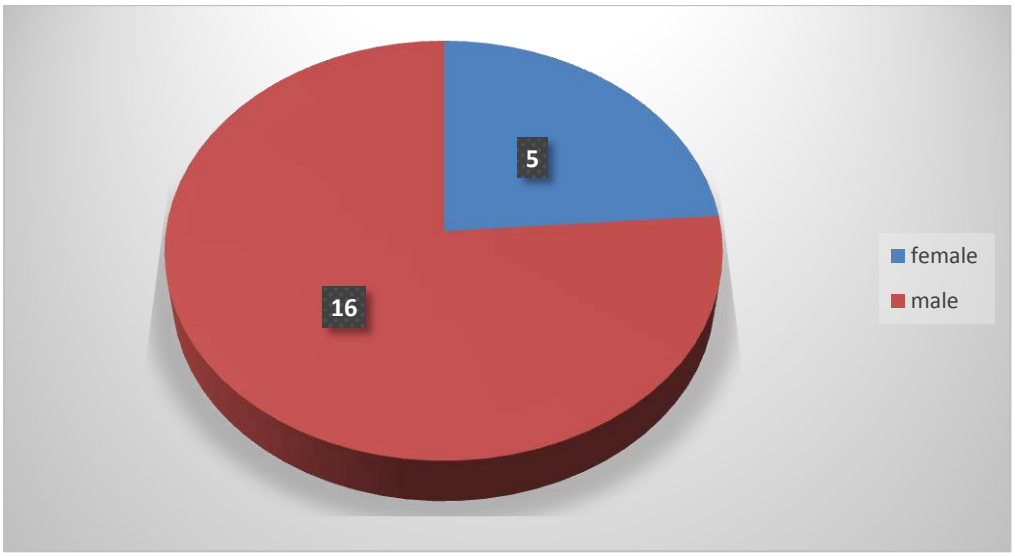


Table 3: Distribution of patients according to mode of injury

MODE OF INJURY	No. of cases	Percentage
FALL FROM HEIGHT	4	19.0%
RSA	17	81.0%
Total	21	100.0%

In 17(81%) patients the cause of injury was road side accident while in 4 patients the cause of injury was fall from height.

Figure 3: Distribution of patients according to mode of injury

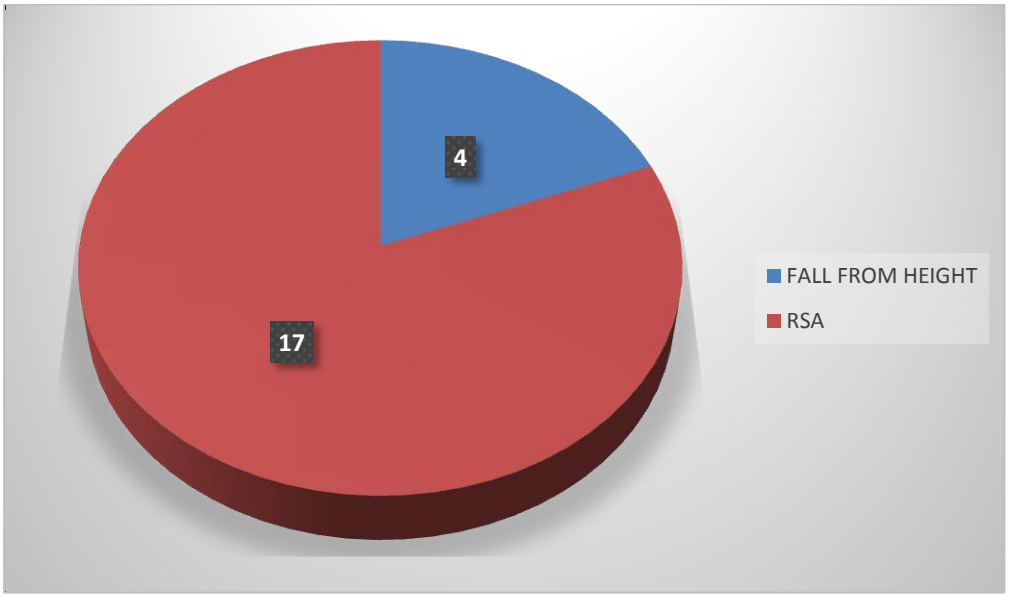


Table 4: Distribution of fracture according to the type of fracture [Letournel and Judet classification]

FRACTURE CLASSIFICATION (LETOURNEL -JUDET)	No. of cases	Percentage
ANTERIOR COLUMN	5	23.8%
ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE	6	28.6%
ASSOCIATED BOTH COLUMN	10	47.6%
Total	21	100.0%

All the fractures of acetabulum were graded according to the Letournel and Judet classification . Out of 21 patients participating in the study , 5 patients(23.8%) presented with anterior column fracture while 6 patients (28.6%) presented with anterior column + posterior hemi-transverse fracture while 10 patients (47.6%) presented with fracture associated both columns .

Figure 4: Distribution of fracture according to the type of fracture [Letournel and Judet classification]

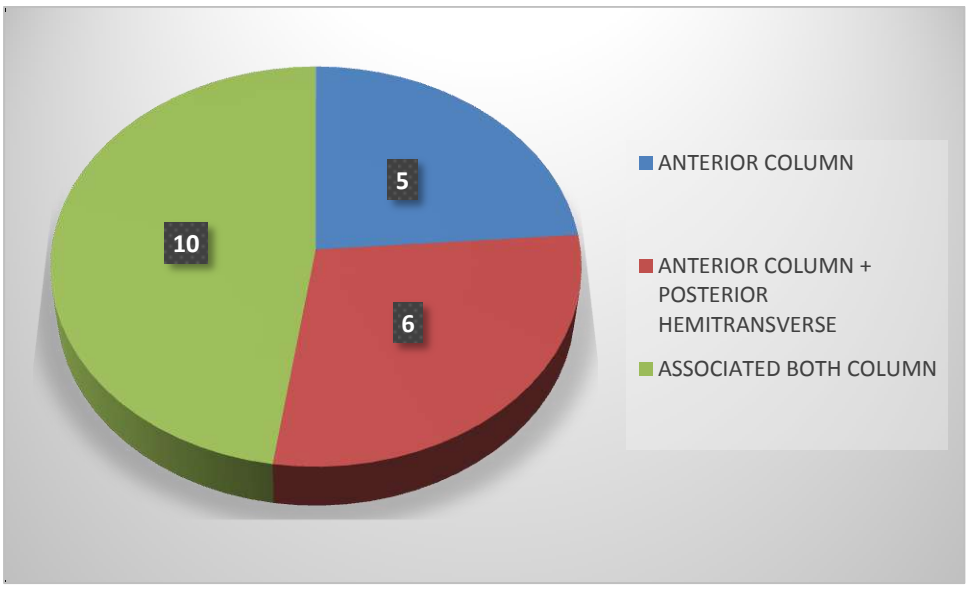


Table 5: Distribution of patients based on hip dislocation

HIP DISLOCATION	No. of cases	Percentage
NONE	16	76.2%
DISLOCATED	5	23.8%
Total	21	100.0%

Hip dislocation was present in 5 patients (23.8%) .

Figure 5: Distribution of patients based on hip dislocation

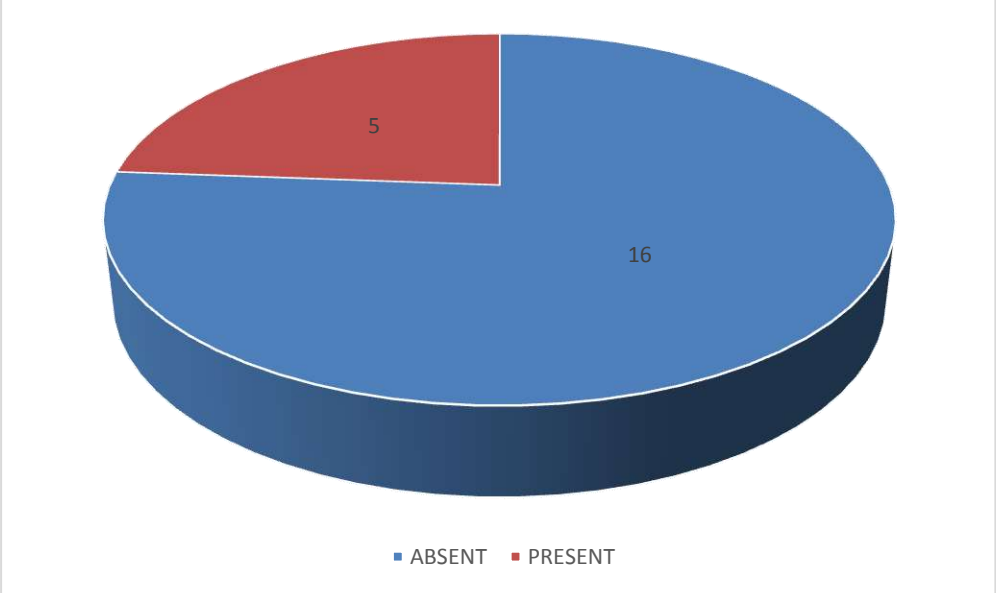


Table 6 : Distribution of patients according to site of fracture (laterality)

SITE OF FRACTURE	No. of cases	Percentage
LEFT SIDE	7	33.3%
RIGHT SIDE	14	66.7%
Total	21	100.0%

In 14 out of 21 patients (66.7%) right side was affected .

Figure 6 : Distribution of patients according to site of fracture (laterality)

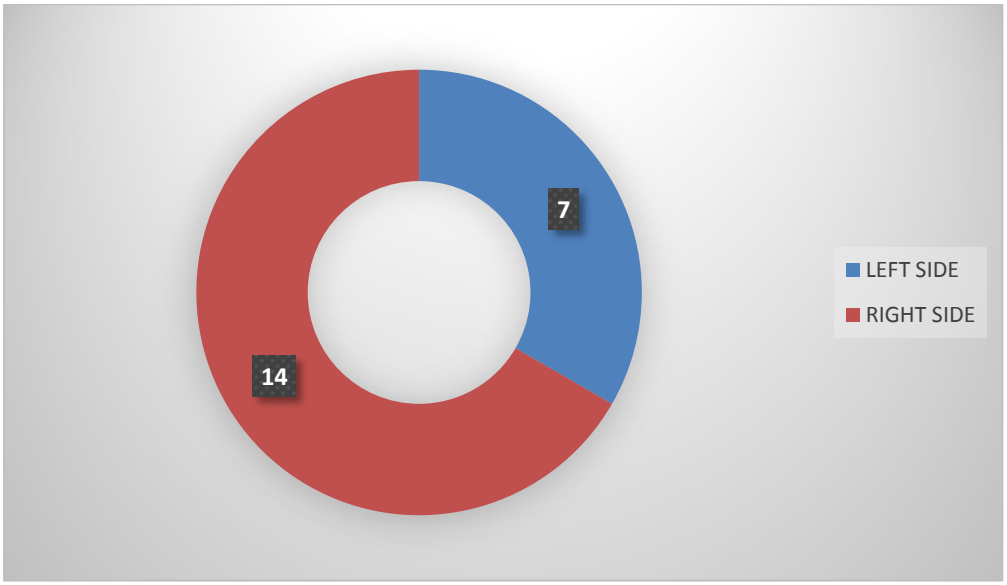


Table 7 : Distribution of patients according to anaesthesia used

GENERAL ANAESTHESIA / SPINAL ANAESTHESIA /CSE	No. of cases	Percentage
CSE(COMBINED SPINAL EPIDURAL)	15	71.4%
GENERAL	6	28.6%
Total	21	100.0%

Out of 21 patients that participated in our study , majority 15(71.4%) patients mode of anaesthesia used was CSE while in 5 patients (28.6%) general anaesthesia was used.

Figure 7 : Distribution of patients according to anaesthesia used

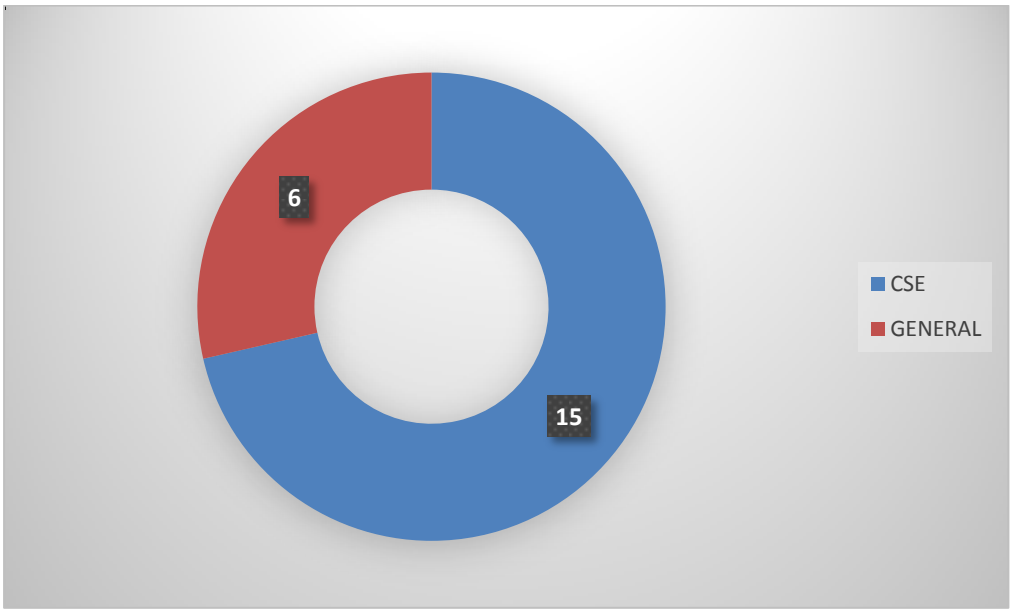


Table 8: Distribution of patients according to surgical approach used

SURGICAL APPROACH USED	No. of cases	Percentage
ILIOINGUINAL APPROACH	12	57.1%
STOPPAS APPROACH	9	42.9%
Total	21	100.0%

In 12 patients (57.1%) ilioinguinal approach was used while in 9 patients (42.9%) stoppas approach was used.

Figure 8: Distribution of patients according to surgical approach used

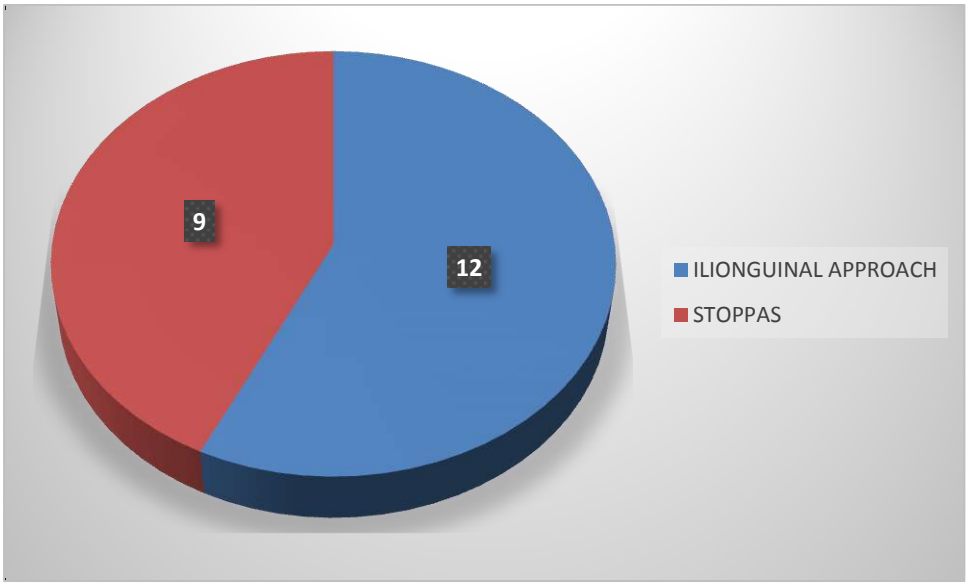
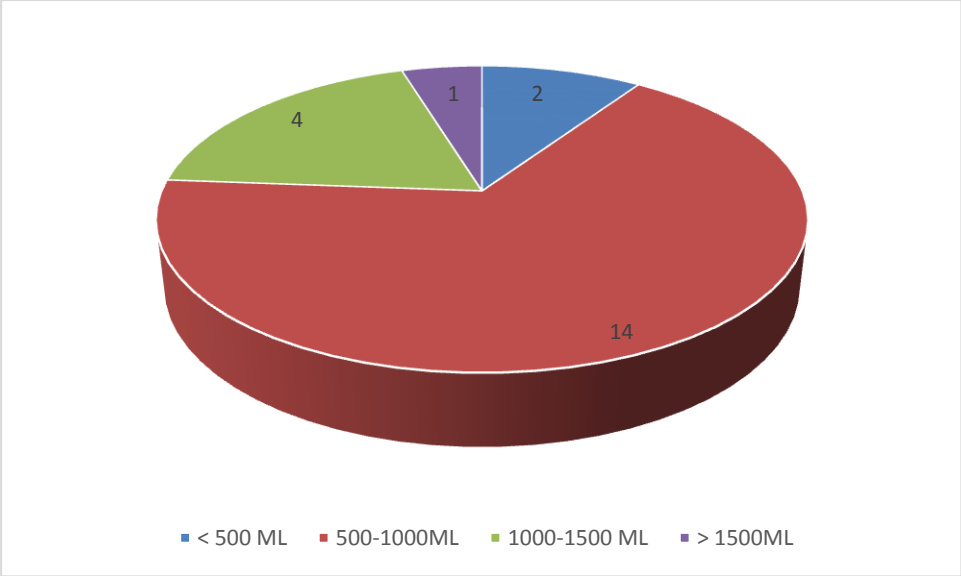


Table 9: Distribution of patients according to blood loss

BLOOD LOSS	No. of cases	Percentage
< 500 ML	2	9.5%
500-1000ML	14	66.7%
1000-1500 ML	4	19.0%
> 1500ML	1	4.8%
Total	21	100.0%

The blood loss was calculated on the basis of number of exact suction volume and the estimated volume absorbed by gauze and dressing .In majority of patients 14(66.7%) , blood loss was 500-1000ml, while in 4 patients (19%) the blood loss was 1000-1500ml. In 2 patients(9.5%), the blood loss was <500 ml while in 1patient (4.8%) it was >1500ml.

Figure 9: Distribution of patients according to blood loss



The complications in the cases included in our study were divided into intraoperative, early postoperative and delayed postoperative complications.

Table 10 Distribution of patients according to intraoperative complications

COMPLICATIONS INTRA OPERATIVE	No. of cases	Percentage
BRADYCARDIA	1	4.8%
HYPOVOLEMIC SHOCK	5	23.8%
INJURY TO LATERAL CUTANEOUS NERVE OF THIGH	2	9.5%
LOSS OF REDUCTION	2	9.5%
TACHYCARDIA	1	4.8%

Out of 21 patients included in our study 11 patients presented with intraoperative complications. In 2 patients injury to the lateral cutaneous nerve of thigh was reported. In 2 patients loss of reduction was reported intraoperatively. 5 patients were reported with hypovolemic shock. In 1 patient tachycardia(Heart rate above 100bpm) was reported.

Figure 10: Distribution of patients according to intra operative complications

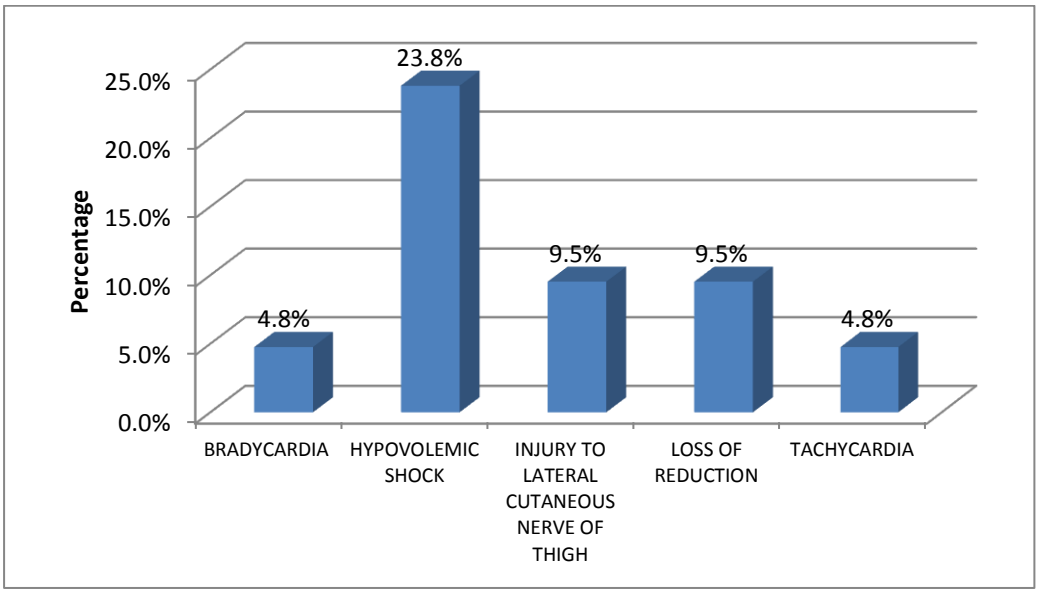


Table 11: Distribution of patients according to early postoperative complication (<72 hours)

COMPLICATIONS POST OPERATIVE	No. of cases	Percentage
HYPOVOLEMIC SHOCK	1	4.8%
DEEP TISSUE INFECTION	1	4.8%
DISCHARGE FROM SUTURE LINE	2	9.5%
HEMATOMA FORMATION	1	4.8%
HIGH GRADE FEVER	2	9.5%
HYPOTENSION	4	19.0%
INTENSE PAIN	1	4.8%

Out of 21 patients included in our study 12 patients presented with early postoperative complications. 2 patients(9.5%) reported discharge from suture line . 2 patients (9.5%) had high grade fever (upto 102 ^{o}F) . 4 patients (19%) reported hypotension (blood pressure below 120/80 mm Hg) . 1 patient (4.8%) reported intense pain (VAS score above 6) . in 1 patient (4.8%) hypovolemic shock was reported .

Figure 11: Distribution of patients according to early post operative complications

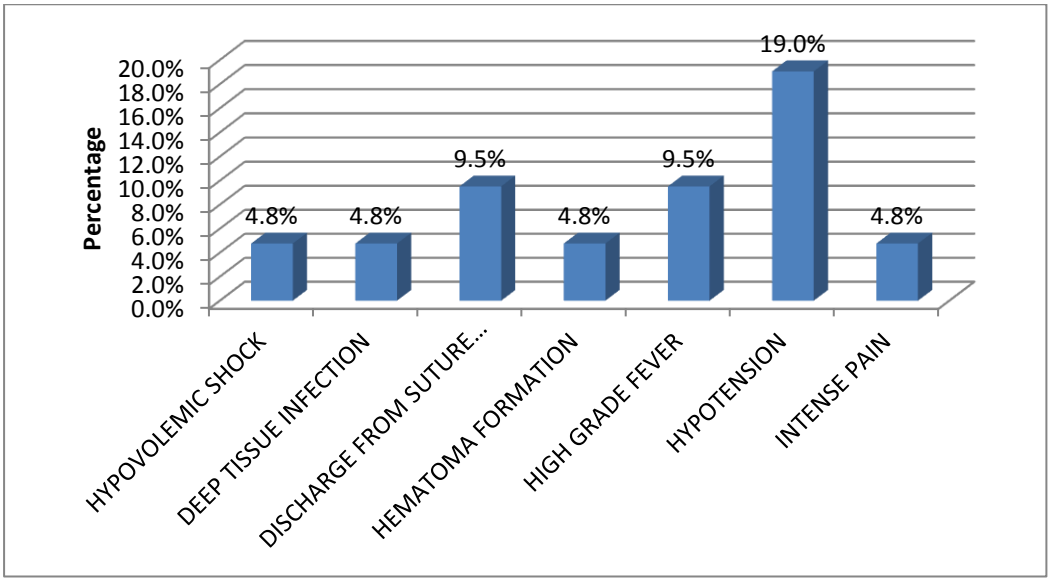


Table 12: Distribution of patients according to delayed complications

COMPLICATIONS DELAYED	No. of cases	Percentage
AVN HIPJOINT	2	9.5%
ABDOMINAL HERNIA FORMATION	1	4.8%
PERSISTANT PAIN	2	9.5%
POST TRAUMATIC ARTHRITIS	2	9.5%
STIFFNESS OF HIP JOINT	2	9.5%

Out of 21 patients included in our study 9 patients presented with delayed post operative complications. 2 patients(9.5%) reported avascular necrosis of hip joint . 2 patients (9.5%) had post traumatic arthritis. 2 patients (9.5%) reported stiffness of the affected hip joint. 2 patients (25%) reported persistent pain (VAS score above 5) .1 patient (4.8%)presented with midline abdominal hernia.

Figure 12: Distribution of patients according to delayed complications

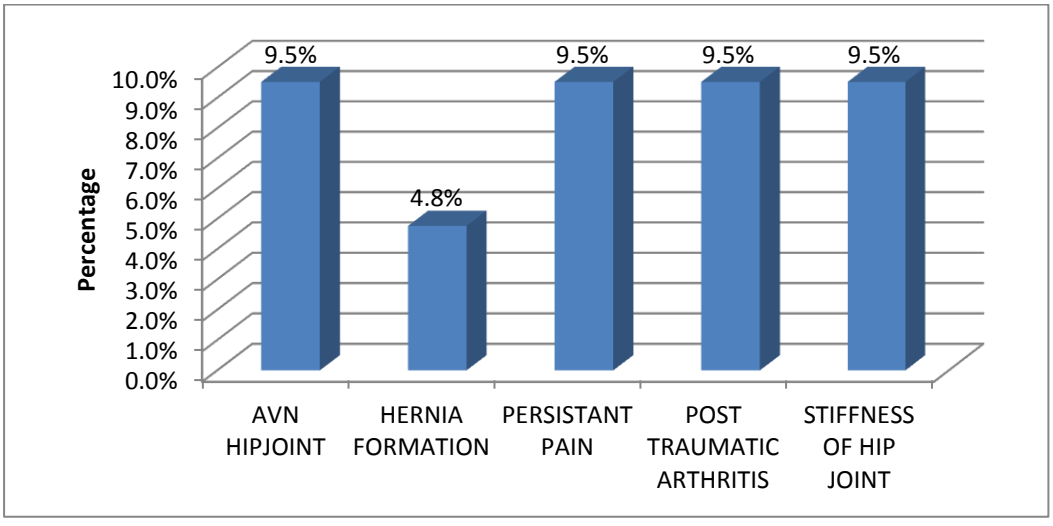


Table 13: Comparison between age group and surgical approaches used

Age group	SURGICAL APPROACH USED					Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
	No. of cases	%age	No. of cases	%age			
< 35	4	33.3%	2	22.2%	6	3.733	0.292
35-45	4	33.3%	1	11.1%	5		
45-55	2	16.7%	5	55.6%	7		
> 55	2	16.7%	1	11.1%	3		
	12	100.0%	9	100.0%	21		

No significant differences were seen among age group and surgical approach used which signifies both groups were comparable with respect to age of the patient.

Figure 13: Comparison between age group and surgical approaches used

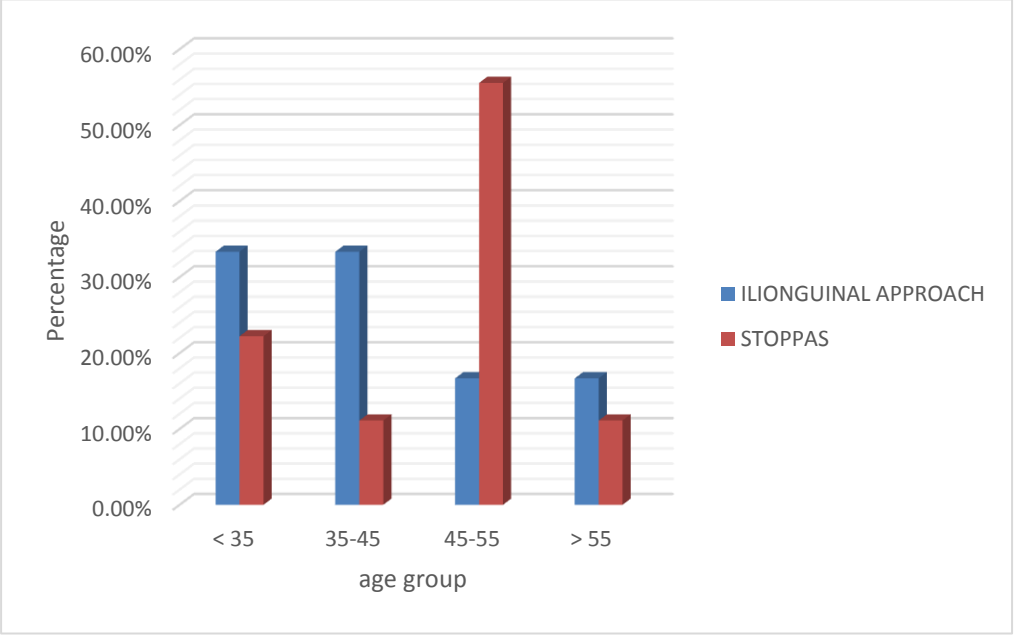


Table 14: Comparison between gender and surgical approaches used

Gender	SURGICAL APPROACH USED					Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
	No. of cases	%age	No. of cases	%age			
Female	3	25.0%	2	22.2%	5	0.022	0.882
Male	9	75.0%	7	77.8%	16		
Total	12	100.0%	9	100.0%	21		

No significant differences were seen among gender and surgical approach used which signifies both groups were comparable with respect to gender of the patients.

Figure 14: Comparison between gender and surgical approaches used

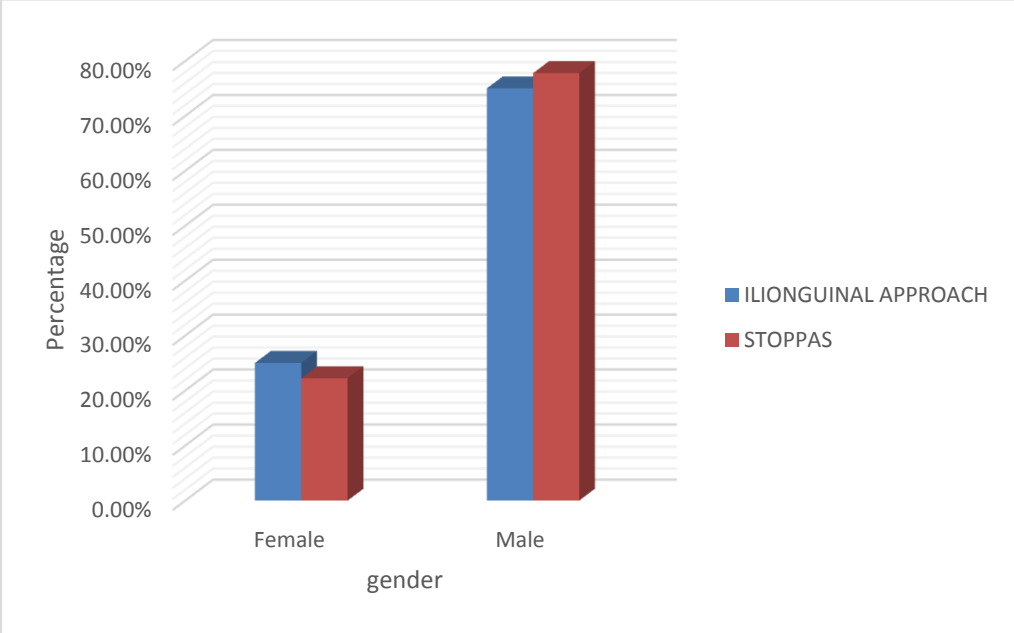


Table 15 A: Comparison between time of surgery and surgical approaches used

TIME OF SURGERY (HOURS)	No. of cases	Percentage
2.5	2	9.5%
3	2	9.5%
3.5	6	28.6%
4	4	19.0%
4.5	3	14.3%
5	4	19.0%
Total	21	100.0%

Out of 21 patients included in our study, in 6 patients (28.6%) the duration of surgery was about 3.5 hours. In 4 patients (19%) the duration of surgery was 4 hours. In 4 patients (19%) the duration of surgery was about 5 hours. In 3 patients (14.3%) the duration of surgery was about 4.5 hours. In 2 patients (9.5%) the duration of surgery was about 3 hours. In 2 patients (9.5%) the duration of surgery was about 2.5 hours.

Table 15 B: Comparison between time of surgery and surgical approaches used

Approach used	**N**	**Mean**	**Std. Deviation**	**t-test**	**p-value**
ilioinguinal	12	3.88	0.856	-0.030	0.93
Stoppas	9	3.89	0.741		

The mean time of surgery was 3.88 hours for ilioinguinal approach and 3.89 hours for stoppas approach . p value was found to be 0.93 which is statistically insignificant . No difference was found in the timing of surgery in comparison to these surgical approaches.

Figure 15: Comparison between time of surgery and surgical approaches used

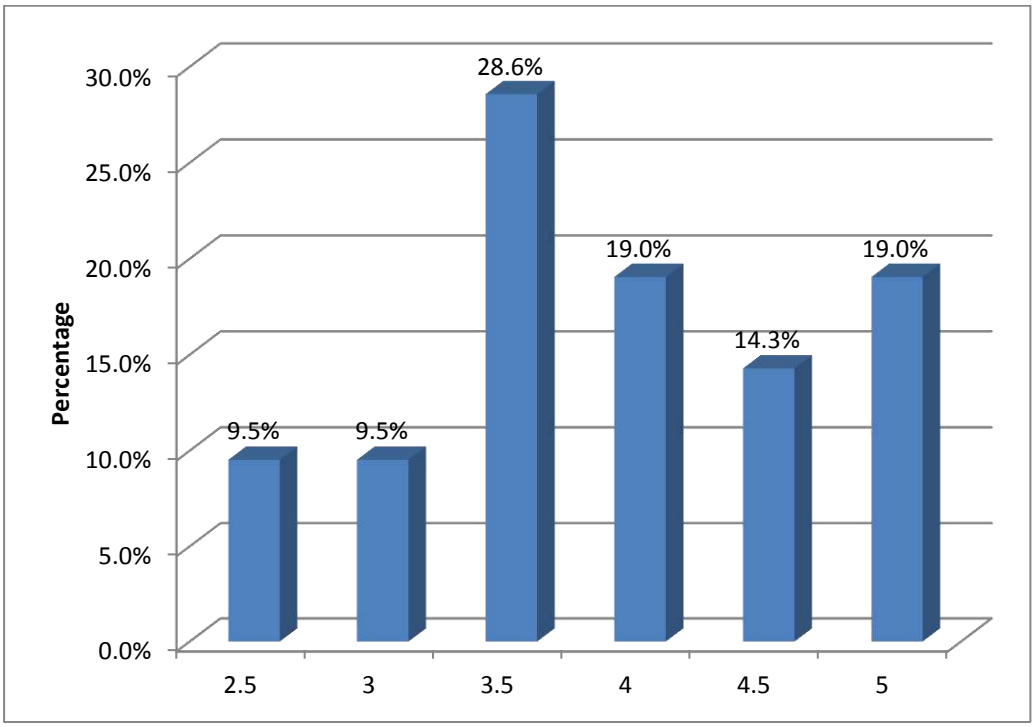


Table 16: Comparison between grouped variables

VARIABLE	SURGICAL PROCEDURE USED				Z	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH			
	Mean	SD	Mean	SD		
AGE (YEARS)	42.17	12.11	46.78	9.86	-0.996	0.319
TIME OF SURGERY (HOURS)	3.88	0.86	3.89	0.74	-0.218	0.828

No significant difference was seen among time of surgery and age of the patient (p>0.05). The mean age for ilioinguinal approach was 42.17±12.11 while for stoppas it was 46.78±9.86 years.

Table 17: Comparison between fracture classification and surgical approaches used

Fracture classification	SURGICAL APPROACH USED				Total	Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH				
	No. of cases	%age	No. of cases	%age			
ANTERIOR COLUMN	3	25.0%	2	22.2%	5	2.081	0.353
ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE	2	16.7%	4	44.4%	6		
ASSOCIATED BOTH COLUMN	7	58.3%	3	33.3%	10		
TOTAL	12	100.0%	9	100.0%	21		

Patients were equally distributed with respect to type of fracture among both groups(p>0.05). In ilioinguinal approach 3(25%) cases and in stoppas approach 2(22.2%) had anterior column fracture. 2 patients (16.7%) in ilioinguinal and 4 patients (44.4%) in stoppas approach had anterior column + posterior hemi transverse fracture while 7 patients (58.3%) in ilioinguinal approach and 3(33.3%) in stoppas approach had associated both column fracture.

Figure 16: Comparison between fracture classification and surgical approaches used

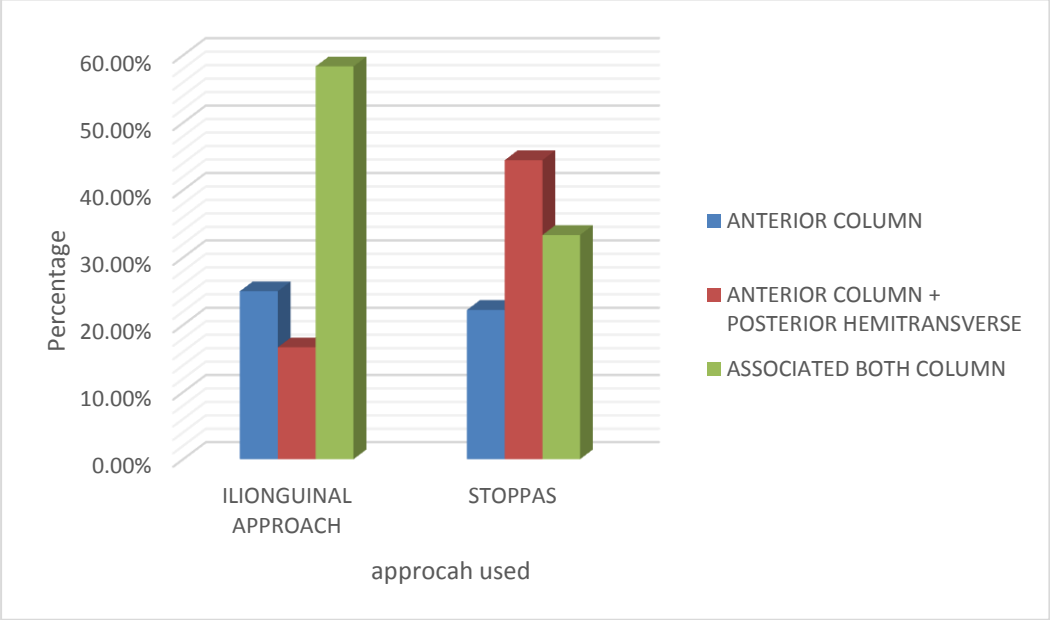


Table 18: Comparison between hip dislocation and surgical approaches used

HIP DISLOCATION	SURGICAL APPROACH USED						
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total	Chi-square value	p-value
	No. of cases	%age	No. of cases	%age			
ABSENT	8	66.7%	8	88.9%	16	1.400	0.237
PRESENT	4	33.3%	1	11.1%	5		
TOTAL	12	100.0%	9	100.0%	21		

Patients were equally distributed with respect to hip dislocation among both groups($p>0.05$)

Figure 17: Comparison between hip dislocation and surgical approaches used

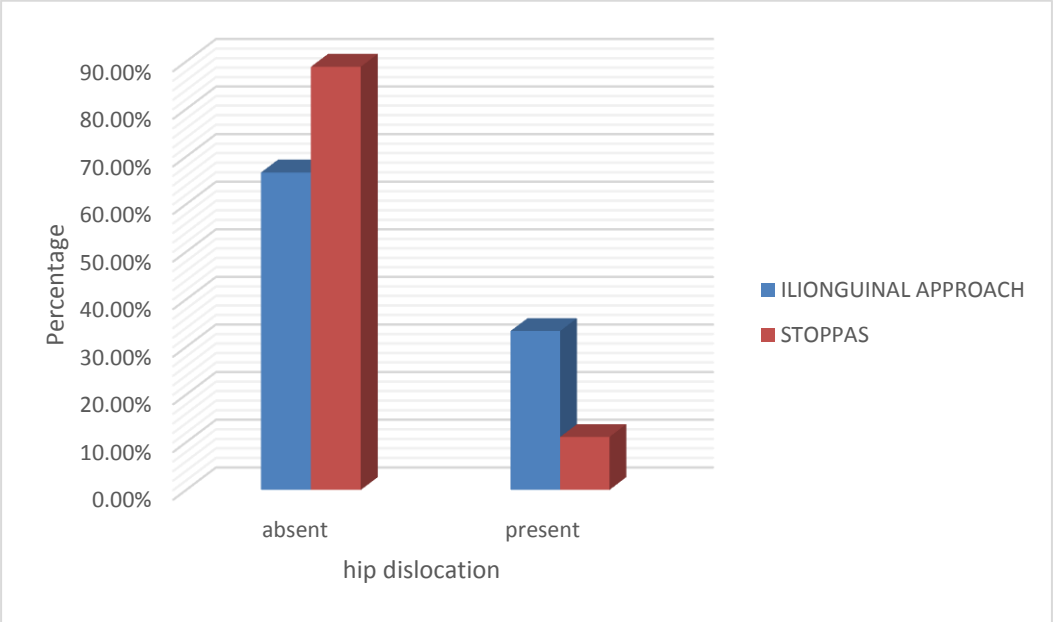


Table 19: Comparison between laterality and surgical approaches used

LATERALITY	SURGICAL APPROACH USED					Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
	No. of cases	%age	No. of cases	%age			
LEFT SIDE	2	16.7%	5	55.6%	7	3.500	0.159
RIGHT SIDE	10	83.3%	4	44.4%	14		
TOTAL	12	100.0%	9	100.0%	21		

Patients were equally distributed with respect laterality among both groups(p>0.05)

Figure 18: Comparison between laterality and surgical approaches used

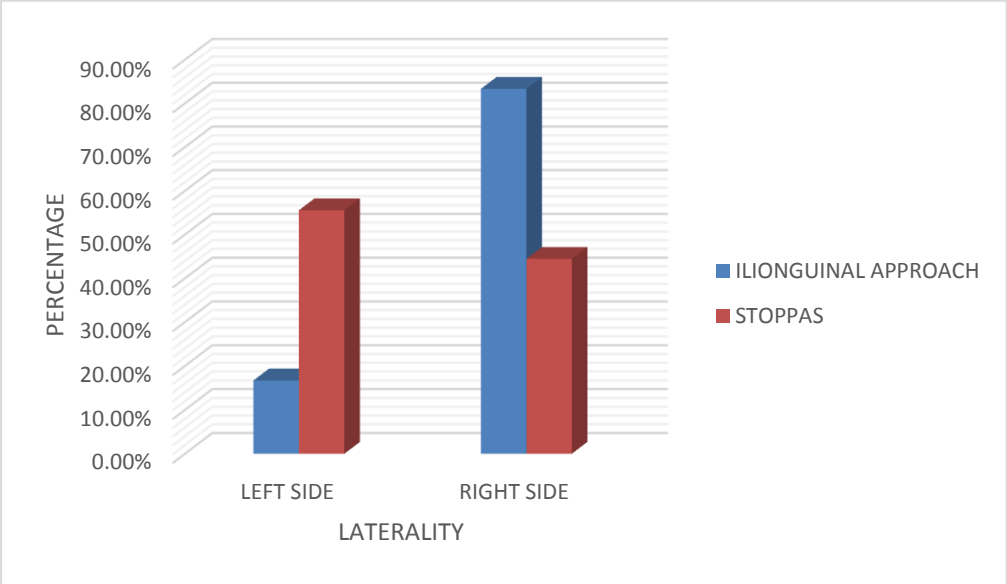


Table 20: Comparison between mode of anaesthesia and surgical approaches used

MODE OF ANAESTHESIA	SURGICAL APPROACH USED					Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
	No. of cases	%age	No. of cases	%age			
CSE	8	66.7%	7	77.8%	15	0.311	0.577
GENERAL	4	33.3%	2	22.2%	6		
TOTAL	12	100.0%	9	100.0%	21		

Patients were equally distributed with respect to mode of anaesthesia among both groups($p>0.05$) and no significant difference was observed among both groups.

Figure 19: Comparison between mode of anaesthesia and surgical approaches used

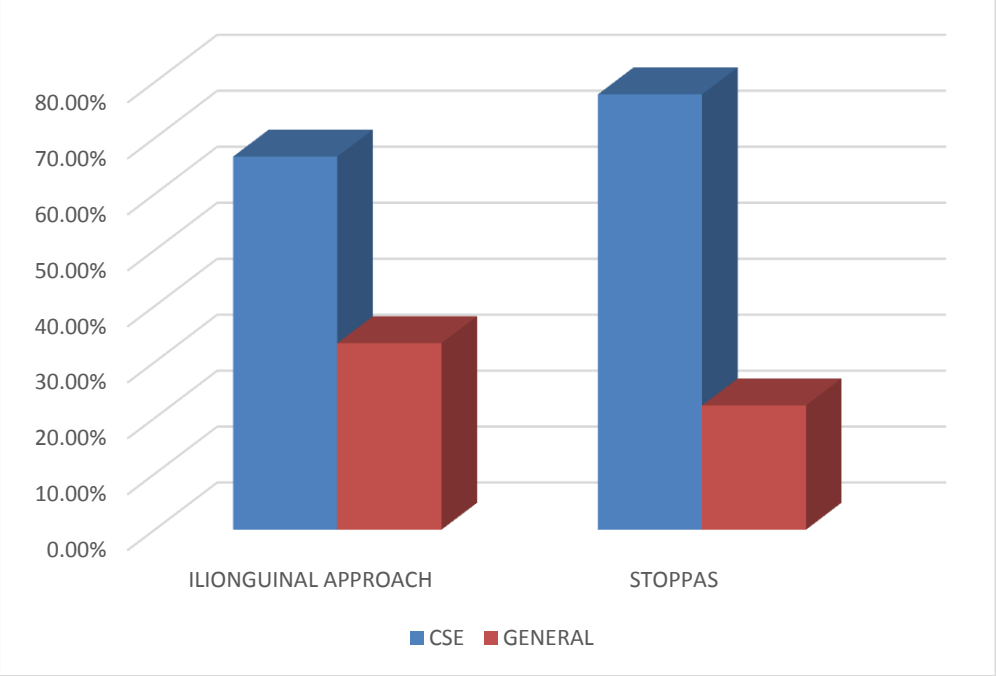


Table 21: Comparison between blood loss and surgical approaches used

BLOOD LOSS	SURGICAL APPROACH USED				Total	Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH				
	No. of cases	%age	No. of cases	%age			
< 500 ML	1	8.3%	1	11.1%	2	1.604	0.658
500-1000ML	7	58.3%	7	77.8%	14		
1000-1500 ML	3	25.0%	1	11.1%	4		
> 1500ML	1	8.3%	0	0.0%	1		
TOTAL	12	100.0%	9	100.0%	21		

The blood loss was calculated on the basis of number of exact suction volume and the estimated volume absorbed by gauze and dressing .In majority of patients 14(66.7%), blood loss was 500-1000ml, while in 4 patients (19%) the blood loss was 1000-1500ml. In 2 patients(9.5%), the blood loss was <500 ml while in 1patient (4.8%) it was >1500ml. Majority of the patients in both ilioinguinal and stoppas approach had blood loss between 500-1000ml .p- value was found out to be 0.658 which is statistically insignificant.

Figure 20: Comparison between blood loss and surgical approaches used

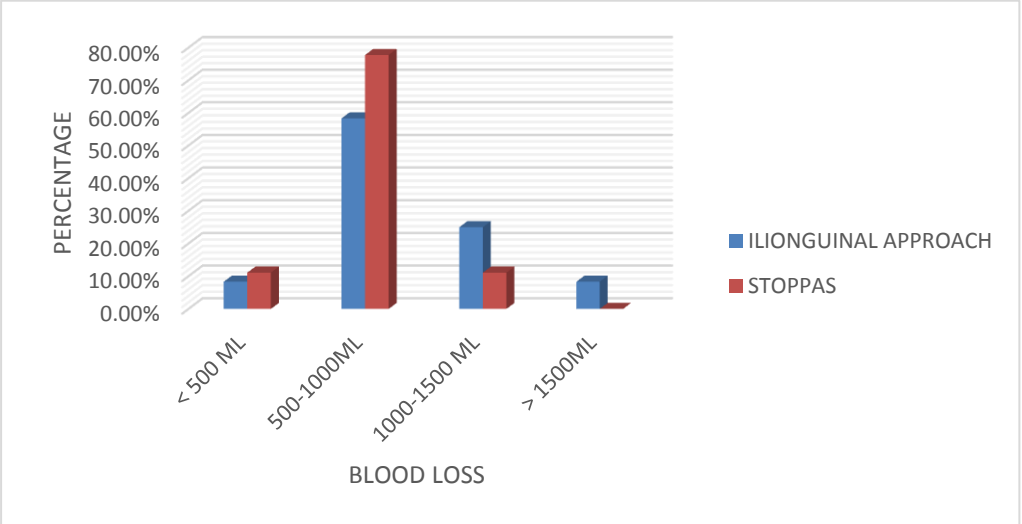


Table 22: Comparison between intraoperative complications and surgical approaches used

COMPLICATIONS INTRA OPERATIVE	ILIONGUINAL APPROACH		STOPPAS APPROACH		Total
	GROUP A	PERCENTAGE	GROUP B	PERCENTAGE	
BRADYCARDIA	0	0.0%	1	11.1%	1
HYPOVOLEMIC SHOCK	3	25.0%	2	22.2%	5
INJURY TO LATERAL CUTANEOUS NERVE OF THIGH	2	16.7%	0	0.0%	2
LOSS OF REDUCTION	1	8.3%	1	11.1%	2
TACHYCARDIA	0	0.0%	1	11.1%	1

Out of 21 patients included in our study , intraoperative complications were reported in 11 patients . The patients were divided into 2 groups depending upon the surgical approach used. In Group A (ilioinguinal approach) 3 patients (25%) presented with hypovolemic shock , in 2 patients (16.7%) injury to lateral cutaneous nerve of thigh was reported , in 1 patient (8.3%) loss of reduction was noted intraoperatively .In Group B (stoppas approach) 2 patients (22.2%) presented with hypovolemic shock , in 1 patient (11.1%) loss of reduction was reported intraoperatively . in 1 patient (11.1%) persistant bradycardia was reported intraoperatively .

Figure 21: Comparison between intraoperative complications and surgical approaches used

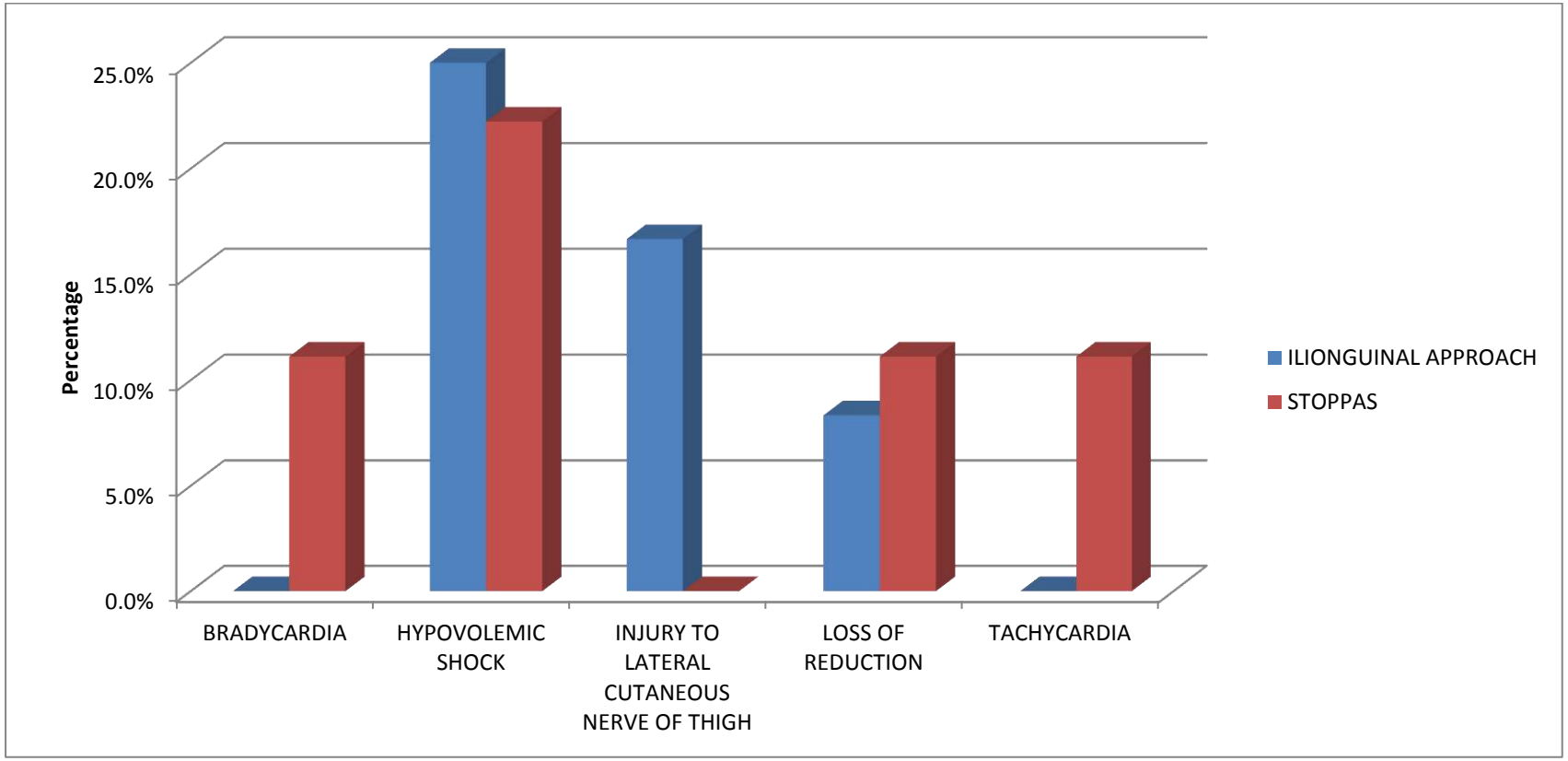


Table 23: Comparison between early postoperative complications and surgical approaches used

	ILIONGUINAL APPROACH		STOPPAS APPROACH		Total
COMPLICATIONS POST OPERATIVE	GROUP A	PERCENTAGE	GROUP B	PERCENTAGE	
HYPOVOLEMIC SHOCK	1	8.3%	0	0.0%	1
DEEP TISSUE INFECTION	0	0.0%	1	11.1%	1
DISCHARGE FROM SUTURE LINE	1	8.3%	1	11.1%	2
HEMATOMA FORMATION	1	8.3%	0	0.0%	1
HIGH GRADE FEVER	1	8.3%	1	11.1%	2
HYPOTENSION	4	33.3%	0	0.0%	4
INTENSE PAIN	0	0.0%	1	11.1%	1

Out of 21 patients included in our study , early postoperative complications were reported in 12 patients . The patients were divided into 2 groups depending upon the surgical approach used. In Group A (ilioinguinal approach) 4 patients (33.3%) presented with hypotension , in 1 patient (8.3%)hematoma formation at incision line was observed , in 1 patient (8.3%) high grade fever (temp above 102^{o}F) , in 1 patient (8.3%) discharge from suture line was observed, in 1 patient (8.3%) hypovolemic shock was observed.

In Group B (stoppas approach) 1 patients (11.1%) presented with intense pain , in 1 patient (11.1%) deep tissue infection was observed , in 1 patient (11.1%) high grade fever (temp above 102^{o}F) , in 1 patient (11.1%) discharge from suture line was observed.

Figure 22: Comparison between postoperative complications and surgical approaches used

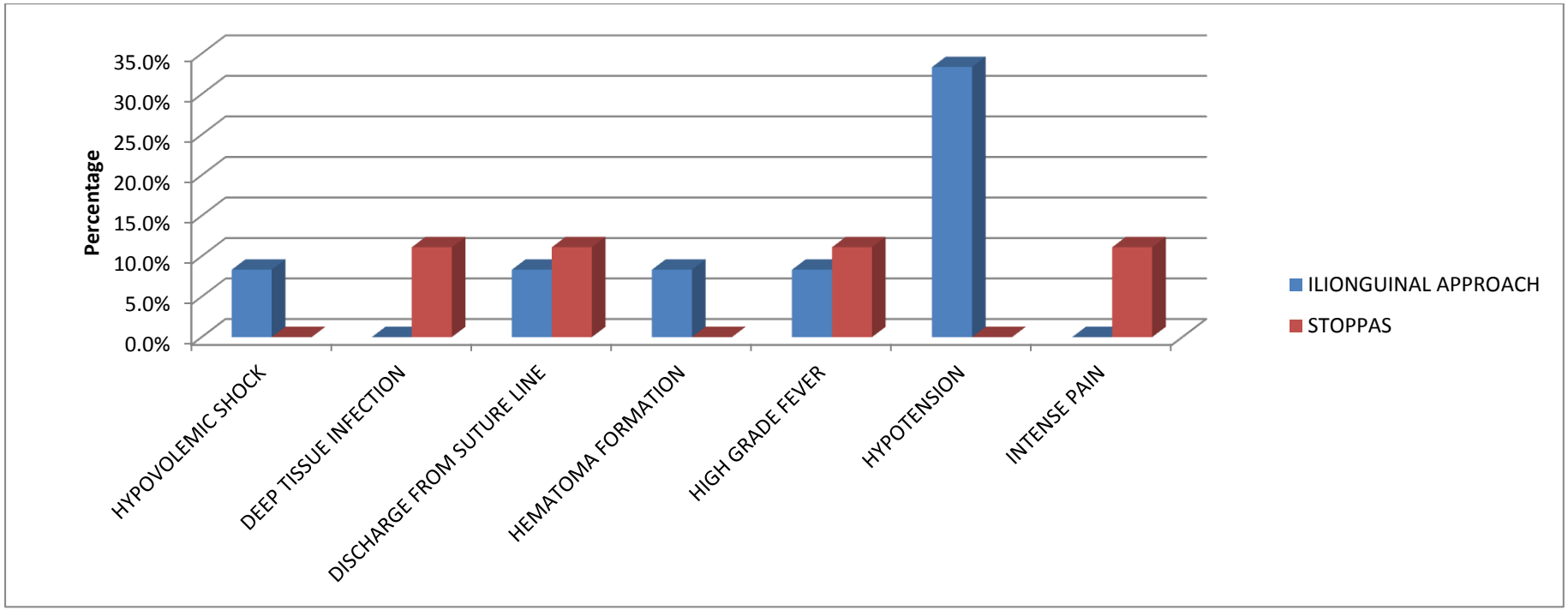


Table 24: Comparison between delayed complications and surgical approaches used

COMPLICATIONS DELAYED	ILIONGUINAL APPROACH		STOPPAS APPROACH		Total
	GROUP A	PERCENTAGE	GROUP B	PERCENTAGE	
AVN HIPJOINT	2	16.7%	0	0.0%	2
HERNIA FORMATION	0	0.0%	1	11.1%	1
PERSISTENT PAIN	1	8.3%	1	11.1%	2
POST TRAUMATIC ARTHRITIS	1	8.3%	1	11.1%	2
STIFFNESS OF HIP JOINT	2	16.7%	0	0.0%	2

Out of 21 patients included in our study, delayed postoperative complications were reported in 9 patients. The patients were divided into 2 groups depending upon the surgical approach used. In Group A (ilioinguinal approach) 2 patients (16.7%) presented with AVN hip joint , 2 patients (16.7%) presented with stiffness at hip joint ,1 patient (8.3%) presented with persistent pain , 1 patient (8.3%) presented with post traumatic arthritis . In Group B (stoppas approach) 1 patients (11.1%) presented with persistent pain, in 1 patient (11.1%) hernia formation was observed , in 1 patient (11.1%) stiffness at the hip joint was observed .

Figure 23: Comparison between delayed complications and surgical approaches used

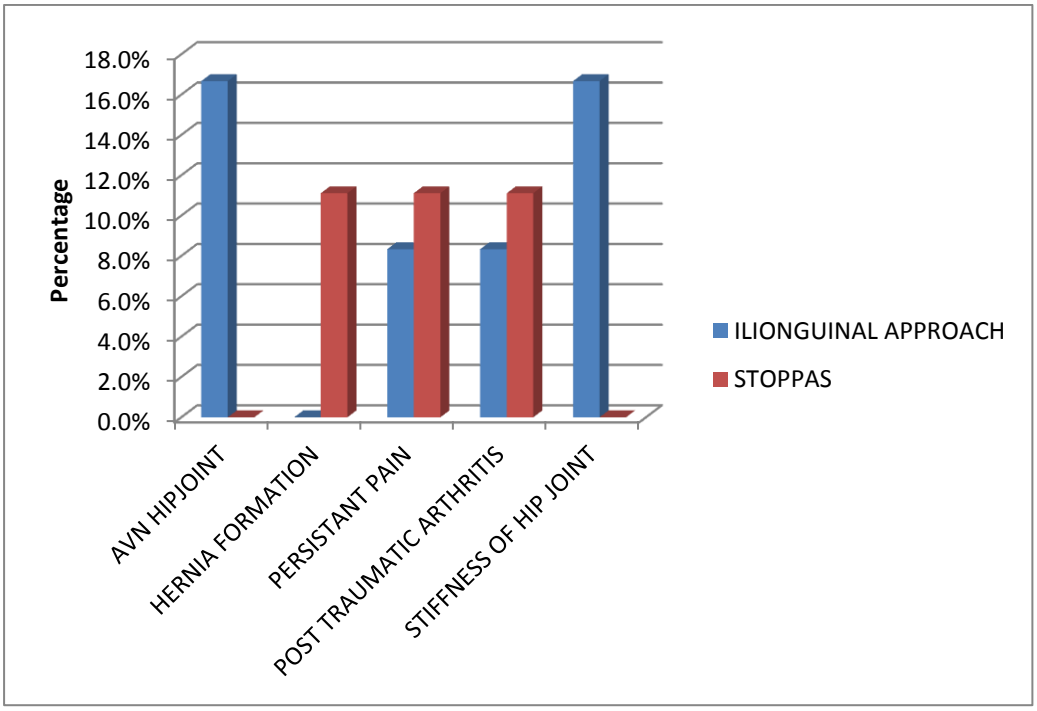


Table 25: Comparison between quality of reduction (MM) and surgical approaches used

DISPLACEMENT IN MM	SURGICAL APPROACH USED					Total	Chi-square value	p-value
		ILIOINGUINAL APPROACH		STOPPAS APPROACH				
		No. of cases	%age	No. of cases	%age			
4 WEEKS	2-3MM	6	50.0%	7	77.8%	13	1.973	0.373
	> 3MM	6	50.0%	2	22.2%	8		
3 MONTHS	2-3MM	9	75.0%	9	100.0%	18	2.625	0.229
	> 3MM	3	25.0%	0	0.0%	3		
6 MONTHS	< 1MM	1	8.3%	1	11.1%	2	0.81	0.667
	2-3MM	10	83.3%	8	88.9%	18		
	> 3MM	1	8.3%	0	0.0%	1		

Quality of reduction was compared according to the Matta's criteria .Patients were equally distributed with respect to displacement in mm among both groups($p>0.05$) and no significant difference was observed among both groups.

Figure 24: Comparison between quality of reduction (MM) and surgical approaches used

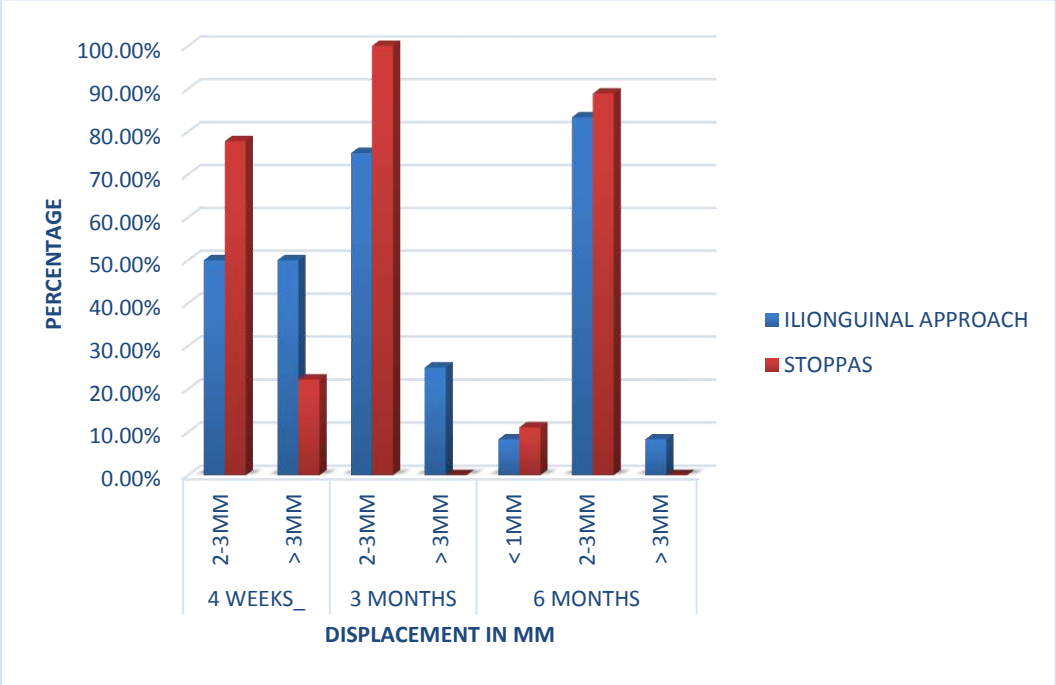


Table 26: Comparison between fracture union and surgical approaches used

RADIOLOGICAL FINDINGS	SURGICAL APPROACH USED				Total	Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH				
	No. of cases	%age	No. of cases	%age			
NON UNITED	1	8.3%	0	0.0%	1	0.788	0.375
UNITED	11	91.7%	9	100.0%	20		
TOTAL	12	100.0%	9	100.0%	21		

Out of 21 patients included in our study , fracture union was observed in majority of the cases . Only in one case operated using ilioinguinal approach the fracture had not united on final follow up. Patients were equally distributed with respect to fracture union among both groups($p>0.05$).

Figure 25: Comparison between radiological findings and surgical approaches used

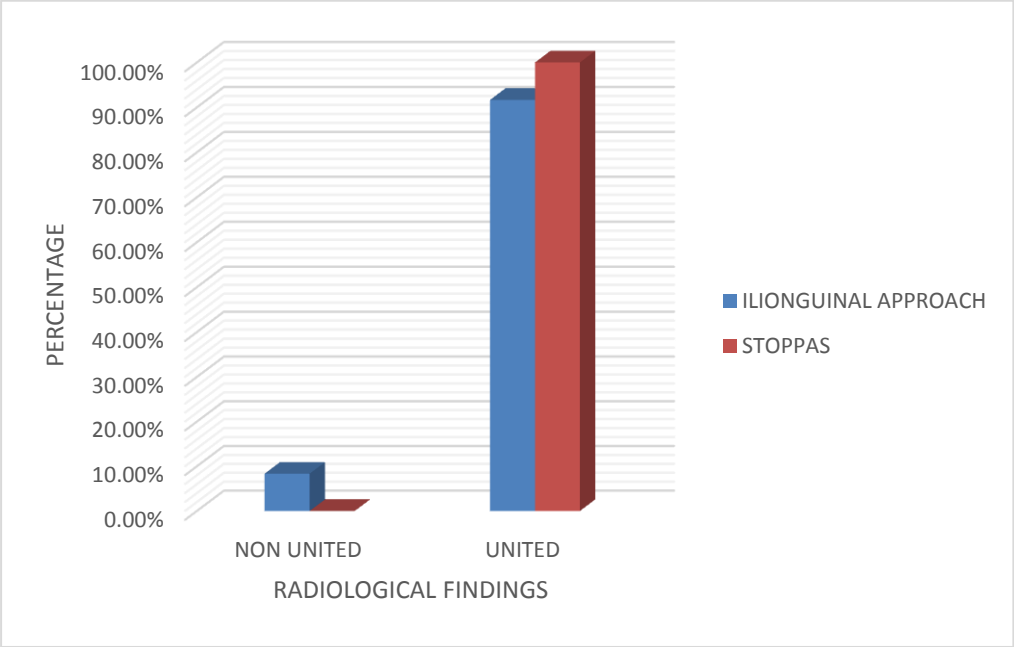


Table 27: Distribution of weight bearing and surgical approaches used

WEIGHT BEARING	SURGICAL APPROACH USED	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
4 WEEKS	NO	12	100.0%	9	100.0%	21		
3 MONTHS	NO	6	50.0%	7	77.8%	13	1.683	0.195
	YES	6	50.0%	2	22.2%	8		
6 MONTHS	YES	12	100.0%	9	100.0%	21		
Total		12	100.0%	9	100.0%	21		

Of the total 21 patients included in our study none of the patients were able to bear weight at the end of 4 weeks. At the end of 3 months 50% patients operated using ilioinguinal approach and 22.2% patients operated using stoppas approach could bear weight. While at end of 6 months 100% patients in both groups could bear weight.

Figure 26: Distribution of weight bearing and surgical approaches used

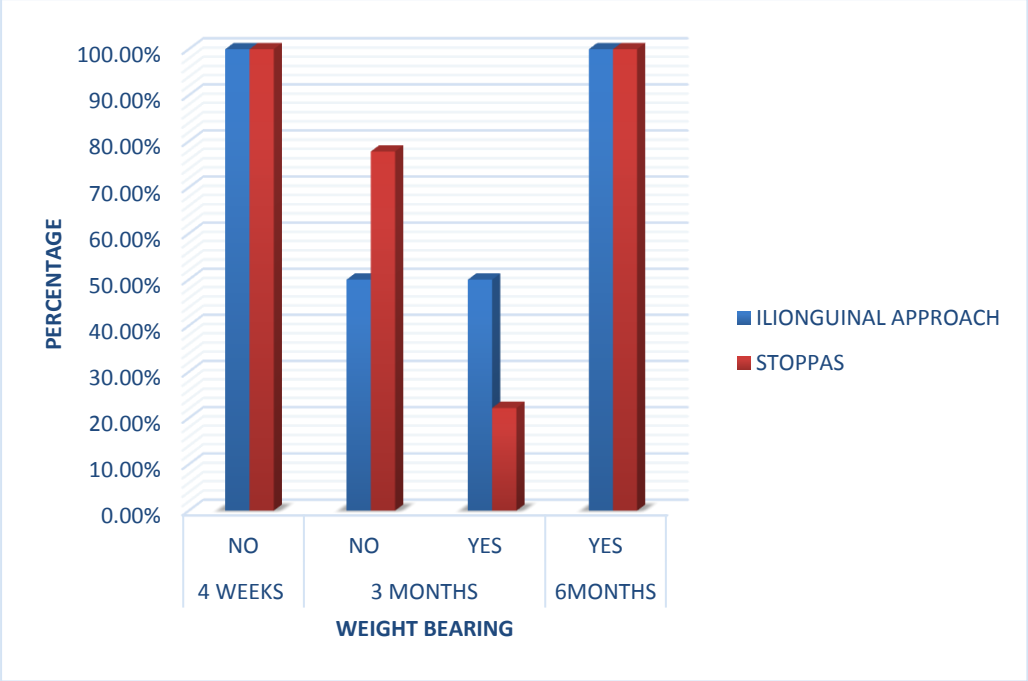


Table 28: Distribution of return to occupation and surgical approaches used

RETURN TO OCCUPATION		SURGICAL APPROACH USED					Chi-square value	p-value
		ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
		No. of cases	%age	No. of cases	%age			
4 WEEKS	NO	12	100.0%	9	100.0%	21		
3 MONTHS	NO	10	83.3%	8	88.9%	18	0.13	0.719
	YES	2	16.7%	1	11.1%	3		
6 MONTHS	NO	3	25.0%	3	33.3%	6	0.175	0.676
	YES	9	75.0%	6	66.7%	15		

Out of 21 patients included in the study, 16 patients were actively working before the injury and 5 were involved in household works. At the end of 4 weeks none of the patients could return to their previous occupations. At the end of 3 months 3 out of 21 patients could return to their previous occupations whereas at the end of 6 months, 15 out of 21 patients were able to return to their previous occupations

Figure 27: Distribution of return to occupation and surgical approaches used

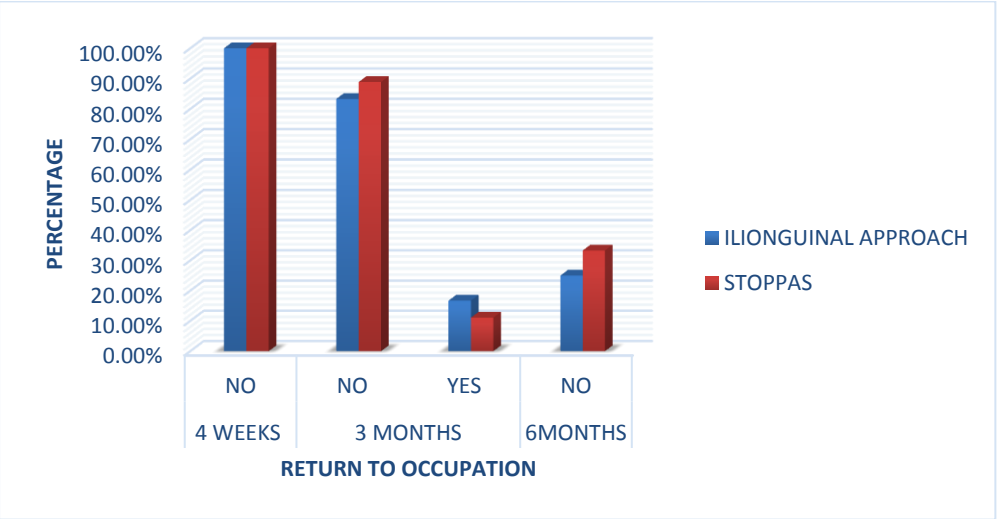


TABLE 29- Merle d' Aubigne and Postel Method score

SCORE	PAIN	MOBILITY	ABILITY TO WALK
0	Pain is intense and permanent	Ankylosis in abnormal position	Impossible
1	Pain is severe, disturbing sleep	Ankylosis in normal position or in a very slight abnormal position	Only with crutches
2	Pain is severe when walking , prevents any activity	Flexion <40 degrees(abduction =0 degrees)or a very light joint deformity	Only with two canes
3	Pain is severe but may be tolerated with limited activity	Flexion <40- 60 degees	Limited with one cane (less than 1 hour). Very difficult without a cane
4	Pain only after walking and dissapearing with rest	Flexion > 60 -80 degrees (can tie shoelaces)	Prolonged with one cane , limited without cane (limp)
5	Very little pain and intermittent and does not preclude normal activity	Flexion >80- 90 degrees Limited abduction (>25degrees)	Without a cane but slight limp
6	No pain at all	Normal flexion >90 degrees , Abduction>25 degrees	Normal

Table 30: Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score

MOBILITY OF HIP		SURGICAL APPROACH USED				Total	Chi-square value	p-value
		ILIOINGUINAL APPROACH		STOPPAS APPROACH				
		No. of cases	%age	No. of cases	%age			
4 WEEKS	1	1	8.3%	0	0.0%	1	2.363	0.501
	2	6	50.0%	7	77.8%	13		
	3	4	33.3%	2	22.2%	6		
	4	1	8.3%	0	0.0%	1		
3 MONTHS	2	2	16.7%	1	11.1%	3	1.069	0.784
	3	5	41.7%	5	55.6%	10		
	4	4	33.3%	3	33.3%	7		
	5	1	8.3%	0	0.0%	1		
6 MONTHS	2	1	8.3%	0	0.0%	1	3.079	0.545
	3	1	8.3%	2	22.2%	3		
	4	3	25.0%	3	33.3%	6		
	5	5	41.7%	4	44.4%	9		
	6	2	16.7%	0	0.0%	2		

According to mobility of hip criteria of Merle d' Aubigne and postel score of functional outcome , out of 21 patients available for final follow up In the study , 2 patients had a score of 6 with flexion more than 90 degrees and abduction upto 30 degrees , 9 patients had a score of 5 with flexion between 80-90 degrees and abduction > 15 degrees . Patients were equally distributed with respect to mobility of hip among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

Table 31: Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score (grouped data)

MOBILITY OF HIP	SURGICAL APPROACH USED				Z	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH			
	Mean	SD	Mean	SD		
4 WEEKS	2.42	0.79	2.22	0.44	-0.661	0.509
3 MONTHS	3.33	0.89	3.22	0.67	-0.269	0.788
6MONTHS	4.50	1.17	4.22	0.83	-0.788	0.431

Patients were equally distributed with respect to mobility of hip among both groups(p>0.05). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months. However at end of 6 months in ilioinguinal approach the mobility of hip was comparatively more (4.50±1.17 mm than stoppas approach4.22±0.83)

Figure 28: Distribution of patients according to mobility of hip criteria according to Merle d' Aubigne and postel score

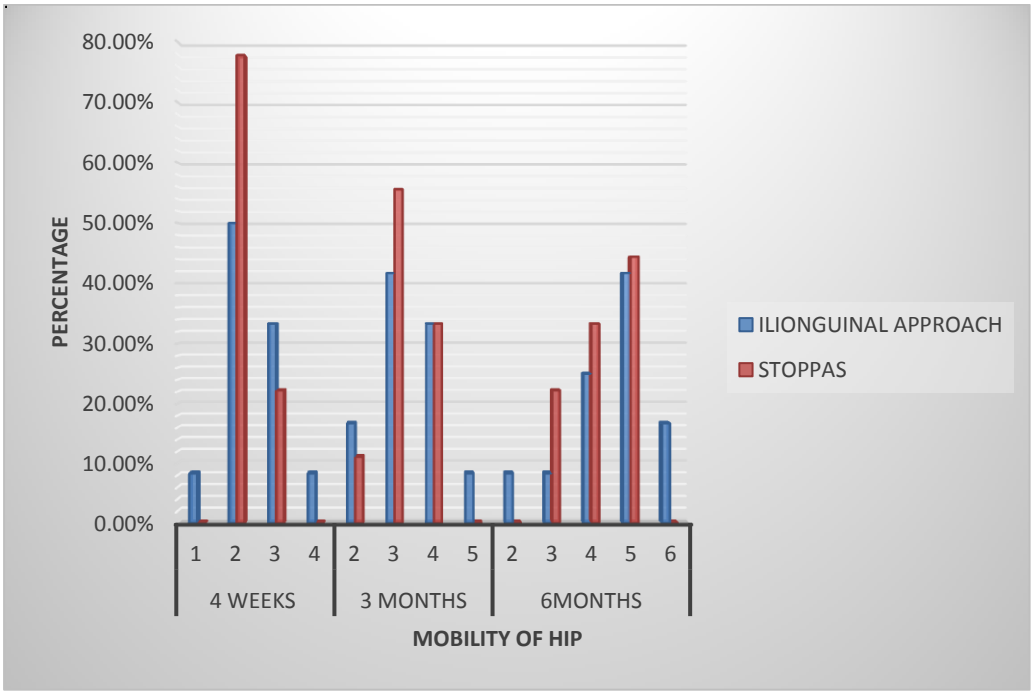


Table 32: Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score

PAIN		SURGICAL APPROACH USED					Chi-square value	p-value
		ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
		No. of cases	%age	No. of cases	%age			
4 WEEKS	1	3	25.0%	1	11.1%	4	2.625	0.453
	2	3	25.0%	5	55.6%	8		
	3	5	41.7%	3	33.3%	8		
	4	1	8.3%	0	0.0%	1		
3 MONTHS	1	1	8.3%	0	0.0%	1	2.100	0.552
	2	1	8.3%	0	0.0%	1		
	3	2	16.7%	3	33.3%	5		
	4	8	66.7%	6	66.7%	14		
6MONTHS	3	2	16.7%	2	22.2%	4	0.583	0.900
	4	3	25.0%	3	33.3%	6		
	5	6	50.0%	3	33.3%	9		
	6	1	8.3%	1	11.1%	2		
Total		12	100.0%	9	100.0%	21		

Patients were equally distributed with respect to pain among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

Table 33: Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score (grouped data)

PAIN	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Z	p-value
	Mean	SD	Mean	SD		
4 WEEKS	2.33	0.98	2.22	0.67	-0.340	0.734
3 MONTHS	3.42	1.00	3.67	0.50	-0.256	0.798
6MONTHS	4.50	0.90	4.33	1.00	-0.451	0.652

Patients were equally distributed with respect to pain among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months. However the pain was comparatively more in ilioinguinal (4.50±0.90) than stoppas approach(4.33±1.00)

Figure 29: Distribution of patients according to pain criteria according to Merle d' Aubigne and postel score

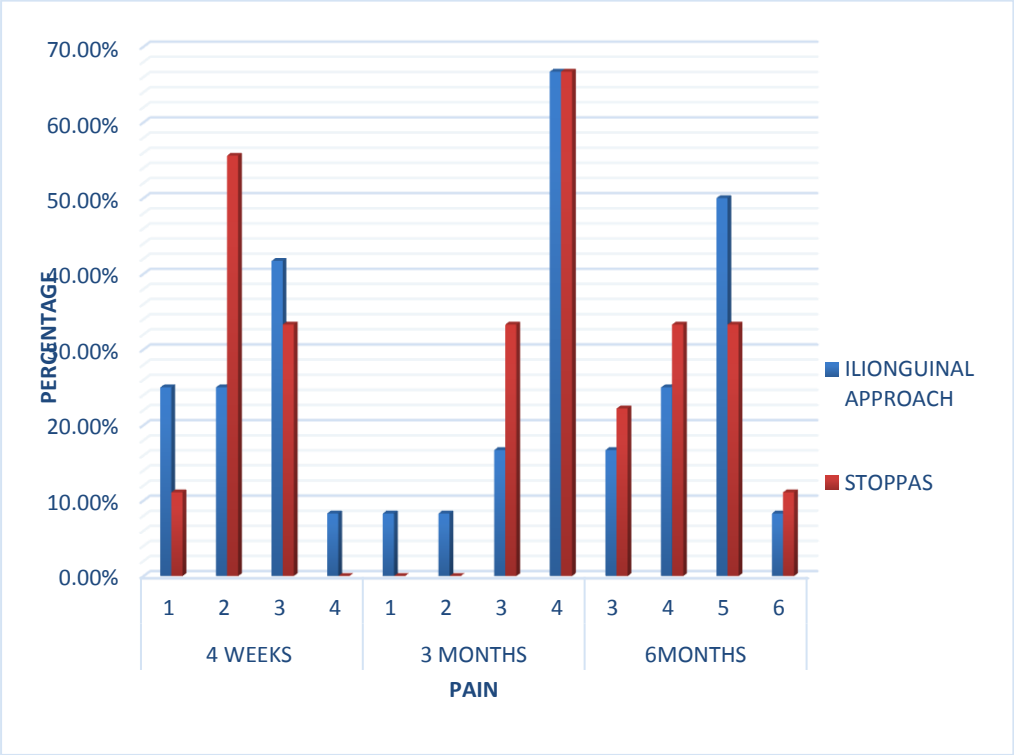


Table 34: Distribution of patients according to ability to walk criteria according to Merle d' Aubigne and postel score

ABILITY TO WALK		SURGICAL APPROACH USED						
		ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
4 WEEKS	0	3	25.0%	3	33.3%	6	1.434	0.698
	1	1	8.3%	2	22.2%	3		
	2	5	41.7%	3	33.3%	8		
	3	3	25.0%	1	11.1%	4		
3 MONTHS	0	1	8.3%	0	0.0%	1	3.281	0.512
	1	1	8.3%	0	0.0%	1		
	2	1	8.3%	3	33.3%	4		
	3	4	33.3%	3	33.3%	7		
	4	5	41.7%	3	33.3%	8		
6MONTHS	3	2	16.7%	2	22.2%	4	0.219	0.975
	4	4	33.3%	3	33.3%	7		
	5	5	41.7%	3	33.3%	8		
	6	1	8.3%	1	11.1%	2		

Patients were equally distributed with respect to ability to walk among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

Table 35: Distribution of patients according to ability to walk criteria according to Merle d' Aubigne and postel score (grouped data)

ABILITY TO WALK	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Z	p-value
	Mean	SD	Mean	SD		
4 WEEKS	1.67	1.15	1.22	1.09	-0.929	0.353
3 MONTHS	2.92	1.31	3.00	0.87	-0.224	0.822
6MONTHS	4.42	0.90	4.33	1.00	-0.224	0.822

Patients were equally distributed with respect to ability to walk (grouped data) among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks, 3 months and 6 months.

Figure 30: Distribution of patients according to ability to walk criteria according to Merle d' Aubigne and postel score

Table 36: Comparison between body movements and surgical approaches used (grouped data)

MOVEMENTS		ILIOINGUINAL APPROACH		STOPPAS APPROACH		Z	p-value
		Mean	SD	Mean	SD		
FLEXION	4WEEKS	42.08	17.90	44.44	14.02	-0.362	0.717
	3 MONTHS	60.00	18.22	62.78	20.48	-0.073	0.942
	6 MONTHS	79.17	24.29	78.89	19.65	-0.108	0.914
EXTENSION	4WEEKS	2.92	2.57	2.78	2.64	-0.124	0.901
	3 MONTHS	6.25	2.26	5.56	3.00	-0.540	0.589
	6 MONTHS	7.08	3.34	8.33	5.00	-0.537	0.592
EXTERNAL ROTATION	4WEEKS	14.58	3.96	16.67	8.29	-0.112	0.911
	3 MONTHS	25.00	7.69	23.33	8.66	-0.416	0.678
	6 MONTHS	29.17	9.00	27.22	9.05	-0.601	0.548
INTERNAL ROTATION	4WEEKS	19.17	11.45	20.56	9.50	-0.037	0.970
	3 MONTHS	25.83	9.96	27.78	6.67	-0.382	0.703
	6 MONTHS	27.92	8.91	27.78	6.67	-0.238	0.812
ADDUCTION	4WEEKS	12.50	6.22	9.44	7.26	-1.091	0.275
	3 MONTHS	17.50	6.22	14.44	7.26	-1.221	0.222
	6 MONTHS	19.17	5.15	18.89	9.28	-0.195	0.845
ABDUCTION	4WEEKS	22.08	11.17	18.89	12.69	-0.448	0.654
	3 MONTHS	27.08	10.10	24.44	10.14	-0.555	0.579
	6 MONTHS	34.17	11.04	31.67	11.46	-0.544	0.586

The Mean flexion at 6 months was 79.17±24.29 for ilioinguinal approach while for stoppas approach it was 78.89 ±19.65.

The Mean extension at 6 months was 7.08±3.34 for ilioinguinal approach while for stoppas approach it was 8.33±5.00.

The Mean external rotation at 6 months 29.17± 9 for ilioinguinal approach while for stoppas approach it was 27.22 ±9.05.

The Mean internal rotation at 6 months 27.92±8.91 for ilioinguinal approach while for stoppas approach it was 27.78 ±6.67.

The Mean Adduction at 6 months was 19.17±5.15 for ilioinguinal approach while for stoppas approach it was 18.89 ±9.28.

The Mean Abduction at 6 months was 34.17±11.04 for ilioinguinal approach while for stoppas approach it was 31.67 ±11.46.

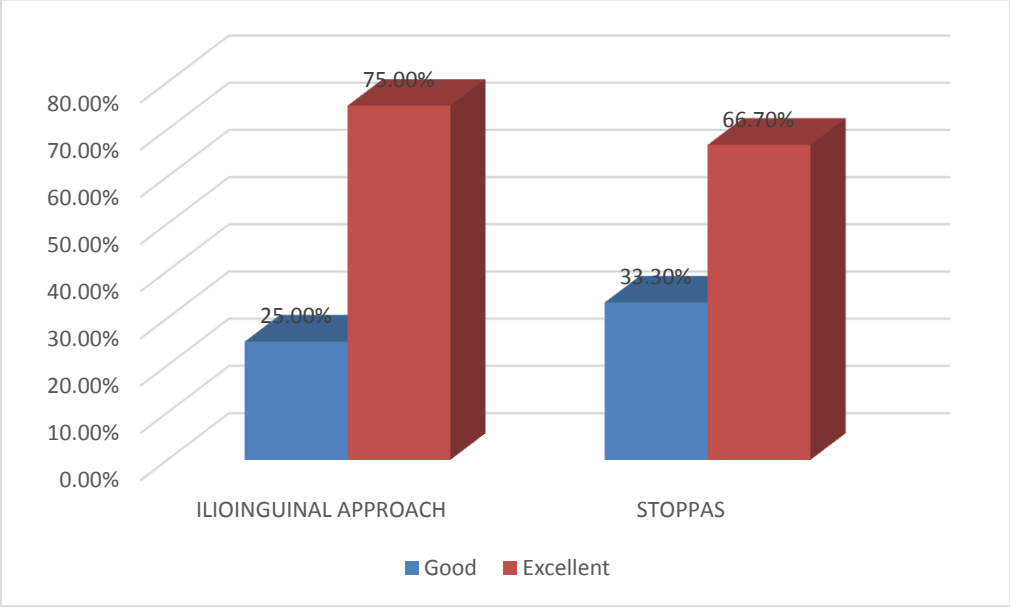
Patients were equally distributed with respect to body movements among both groups(p>0.05). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

Table: 37: Comparison according to Merle d' Aubigne and Postel SCORE

Merle d' Aubigne and Postel score	SURGICAL APPROACH USED					Chi-square value	p-value
	ILIOINGUINAL APPROACH		STOPPAS APPROACH		Total		
	No. of cases	%age	No. of cases	%age			
Good	3	25.0%	3	33.3%	6	.175	.523
Excellent	9	75.0%	6	66.7%	15		
Total	12	100.0%	9	100.0%	21		

No significant difference was seen between ilioinguinal approach and stoppas approach regarding the pain, mobility, ability to walk. 66.7% patients have excellent outcome after 6 months in stoppas while 75% have excellent outcome after 6 months in ilioinguinal approach.

Figure 31: Comparison according to Merle d' Aubigne and Postel score



DISCUSSION

Acetabular fractures pose a great challenge for orthopaedic trauma surgeons. The first known descriptions of surgical fixation of acetabular fractures were case reports in 1943. In 1964, Robert Judet, Jean Judet, and Émile Letournel published a landmark article describing a classification system and surgical approaches to treat acetabular fractures. These teachings had a significant effect on clinical outcomes after surgical fixation of acetabular fractures. In 1980, Letournel demonstrated 80% good-to-excellent results in 492 operated hip cases and in 2012, Joel Matta demonstrated 79% survivorship in 816 patients follow surgical acetabular fixation. Both Letournel and Matta have concluded anatomic reduction of the fracture is the most influential factor predictive of clinical outcome.[45]

The present study was conducted in Department of Orthopaedics in Dayanand Medical College & Hospital, Ludhiana from January 2019 to January 2023 to evaluate and compare Stoppas and Ilioinguinal approach for anterior acetabulum fractures in terms of Anatomical reduction , Complications and Functional outcomes. Total 21 cases were admitted in the department of orthopaedics and those patients who fulfilled the inclusion and exclusion criteria were included in the study. In 12 patients (57.1%) ilioinguinal approach was used while in 9 patients (42.9%) stoppas approach was used.(Table 9).

The results of the present study are discussed below:

DEMOGRPHICS

AGE

We observed that out of 21 patients included in our study 7(33.3%) patients belonged to the age group 45-55 years, followed by <35 years 6 patients (28.6%), 35-45 years 5 patients (23.8%) and >55 years 3 patients (14.3%). The mean age of the patient was 44.14±11.18 years.(Table 1)

Kadirvelu et al[46] in their study found that of the total 25 cases of acetabulum fractures 7 had anterior column fracture and out of them 5 cases were between 50-59 years. The youngest patient was 40 years old and eldest patient was 52 years old with overall average age 41 years. In a study by Trikha et al[47] the mean age of the patients with anterior wall acetabulum fracture was 39.6 years. In a study by Giannoudis et al[48] of total 400 acetabulum fractures 30 were isolated anterior fractures of the acetabulum. These 30 patients had a mean age of 46.8 years (20 to 86). In a study by Aziz et al[44] the mean age of the patient was 45 years**.**

The mean age of our study was in accordance to the above mentioned studies. **We observed that No significant difference was seen among age of the patient (p>0.05). The mean age for ilioinguinal approach was 42.17±12.11 years while for stoppas approach was 46.78±9.86 years**

GENDER

We observed that majority of patients included in our study 16 patients (76.2%) were male while 5(23.8%) patients were females (Table 2). In a study by Elmadağ et al[38] 27/36 patients (75%) patients were males. In a study by Giannoudis et al[48] 66.67 % patients with anterior acetabulum fractures were males. In a study by Alzzahar et al[49] there are 562 men (69%) and 257 women (31%). Our study was in accordance to the above mentioned studies .

MODE OF INJURY

We observed that majority of patients included in our study 17(81%) patients the mode of injury was road side accident while in 4 patients the mode of injury was fall from the height.(Table 4) Fractures of the acetabulum occur by the impact of the femoral head on the articular surface.[4] The pattern depends on the position of the hip at the time of impact; external rotation will result in anterior fracture patterns, and internal rotation will result in posterior fracture patterns. Falls on

the greater trochanter will most likely result in an anterior column and/or wall fracture.[4]

The results of the present study were in accordance with the study conducted by Giannoudis et al[48] where road traffic accidents and falls from a height were the cause of the injury in 21 (70%) and nine (30%) patients, respectively.

Adawy et al[43] In their study showed that 9 patients in Stoppas group and 7 patients in ilioinguinal group had motor car accidents as the mode of injury whereas 2 patients in stoppas group and 6 patients in ilioinguinal group had fall from height as the mode of injury.

LETOURNEL -JUDET CLASSIFICATION

We observed that in our study that according to letournel -judet classification 5 patients(23.8%) presented with anterior column fracture while 6(28.6%) patients presented with anterior column + posterior hemi-transverse fracture while in 10 patients (47.6%) presented with associated both column fracture (Table 5). Hip dislocation was present in 5(23.8%) of the patients (table 6). The patients were equally distributed in both the groups.

In a study by Giannoudis et al[48] total of 26 patients (86.6%) presented with anterior acetabular fractures . In their study all fractures were closed and one was associated with an anterior dislocation of the hip.

In a study by Marcelo Cortês Cavalcante, et al[50] a total of 11 cases presented with anterior acetabulum fracture out of which 2 cases involved Anterior column fractures , 7 cases involved Anterior column + posterior hemitransverse while Anterior wall + posterior hemitransverse was seen in 2 cases.

In a study by Aziz et al[44] In stoppas group, 7 patients had anterior column fractures, 3 patients had transverse fracture, 2 patients had anterior column with posterior hemi-transverse fracture, and 1 patient had pelvic ring fracture with pubic diastasis. In ilioinguinal group, 6 patients had anterior column fractures, 2 patients had transverse

fractures and remaining 4 patients had anterior column with posterior hemi-transverse fractures.

In a study by Adawy et al[43] in stoppas, 9 patients (45%) had associated both column fractures, 6 patients (30%) had T type fractures, and 5 patients (25%) had anterior column fractures while in ilioinguinal group, 8 patients (45%) had associated both column fractures, 4 patients (22%) had T type fractures, and 6 patients (33%) had anterior column fractures.

In ilioinguinal approach 3(25%) cases and in stoppas approach 2(22.2%) had anterior column fracture. 2 patients (16.7%) in ilioinguinal approach and 4 patients (44.4%) in stoppas approach had anterior column + posterior hemitransverse while 7patients (58.3%) in ilioinguinal approach and 3patients (33.3%) in stoppas approach had associated both column fractures

The results of our study were in accordance to the study done by M.Elmadağ et al.[38] they reported that in ilioinguinal group , the fracture type was anterior column in 13 patients (68%), transverse type in 2 patients (10%) and anterior column + posterior hemi transverse in 4 patients (20%). In stoppas group , the fracture type was anterior column in 10 patients (58%), transverse type in 3 patients (17%) and anterior column + posterior hemi transverse in 4 patients (23%).

No significant differences were seen between surgical approach used and gender, occupation, cause of injury, type of fracture, hip dislocation, laterality, mode of anaesthesia, management and implant used which signifies both groups were comparable with respect to these parameters.

BLOOD LOSS

The blood loss was calculated on the basis of number of exact suction volume and the estimated volume absorbed by gauze and dressing Corona mortis (anastomosis between the obturator and the external

iliac or inferior epigastric arteries or veins) was observed in 3 out of 9 patients operated using stoppas approach and 4 out of 12 patients operated using ilioinguinal approach .The patients were divided into 2 groups depending upon the surgical approach used . Group A (ilioinguinal approach) and Group B(stoppas approach . In group A 1 patient (8.3%) had blood loss of less than 500 ml intraoperatively , 7 patients (58.3%) had blood loss of 500-1000ml , 3 patients (25%) had blood loss of 1000-1500 ml and 1 patient had blood loss of > 1500 ml . In group B 1 patient (11.1%) had blood loss of less than 500 ml intraoperatively , 7 patients (77.8%) had blood loss of 500-1000ml , 1 patient (11.1%) had blood loss of 1000-1500 ml .

We observed that in ilioinguinal approach more blood loss was measured as compared to stoppas but it was statistically not significant ($p>0.05$). The results were in accordance with the study conducted by Meena et al who observed no significant difference in terms of blood loss was found in both the ilioinguinal and stoppas group. In a study by Elmadağ et al[38] blood loss was determined as mean 1170 mL (range, 750–2150 mL) in ilioinguinal group and as mean 1110 mL (range, 450–2000 mL) in stoppas group and this was not found to be statistically significant ($P = 0.168$). These results were in accordance with the current study.

COMPLICATION

We observed that out of 21 patients included in our study , intraoperative complications were reported in 11 patients . The patients were divided into 2 groups depending upon the surgical approach used. In Group A (ilioinguinal approach) 3 patients (25%) presented with hypovolemic shock for which ionotropic support was given intraoperatively , in 2 patients (16.7%) injury to lateral cutaneous nerve of thigh was reported , in 1 patient (8.3%) loss of reduction was noted intraoperatively .In Group B (stoppas approach) 2 patients (22.2%) presented with hypovolemic shock , in 1 patient (11.1%) loss of reduction was reported intraoperatively .In 1 patient (11.1%) persistant bradycardia was reported intraoperatively .

We observed that out of 21 patients included in our study , early postoperative complications were reported in 12 patients . In Group A (ilioinguinal approach) 4 patients (33.3%) presented with hypotension , in 1 patient (8.3%)hematoma formation at incision line was observed , in 1 patient (8.3%) high grade fever (temp above 102^{o}F) , in 1 patient (8.3%) discharge from suture line was observed, in 1 patient (8.3%) hypovolemic shock was observed. In Group B (stoppas approach) 1 patients (11.1%) presented with intense pain , in 1 patient (11.1%) deep tissue infection was observed , in 1 patient (11.1%) high grade fever (temp above 102^{o}F) , in 1 patient (11.1%) discharge from suture line was observed.

We observed that out of 21 patients included in our study , delayed postoperative complications were reported in 9 patients . In Group A (ilioinguinal approach) 2 patients (16.7%) presented with AVN hip joint , 2 patients (16.7%) presented with stiffness at hip joint ,1 patient (8.3%) presented with persistent pain , 1 patient (8.3%) presented with post traumatic arthritis . In Group B (stoppas approach) 1 patients (11.1%) presented with persistent pain , in 1 patient (11.1%) hernia formation was observed , in 1 patient (11.1%) stiffness at the hip joint was observed.

Intra operative complications were seen in 28.57% of patients operated using ilioinguinal approach , 23.8% in patients operated using stoppas approach . Early postoperative complications were seen in 38.09% of patients operated using ilioinguinal approach , 19.04% in patients operated using stoppas approach. Delayed postoperative complications were seen in 28.57% of patients operated using ilioinguinal approach , 14.28% in patients operated using stoppas approach. We found out in our study that predilection for intraoperative complications were more for ilioinguinal group as compared to the stoppas group . Complications like injury to the lateral cutaneous nerve of thigh were only limited to the ilioinguinal group.

In a study by Elmadag et al[38] the mean complication rate was 31% in ilioinguinal approach (group A) (6 patients) and 23% in stoppas approach (Group B) (4 patients) ($P > 0.05$). In group A, loss of sensibility secondary to lateral femoral cutaneous nerve injury developed in 2 patients. Soft tissue infection developed in 2 patients, delayed union was observed in 2 patients in Group A. In Group B, sciatica symptoms developed in 1 patient, Soft tissue infection (treated with antibiotic therapy) was observed in 2 patients.

Meena et al[12] showed that modified stoppas approach was associated with a significantly lower complication rate. Complications such as hernia, thrombosis, neurovascular injuries and hematoma were seen at the rate of approximately 10% in the Ilioinguinal approach. A study by AZIZ et al[44] showed mean complication rate of 23.07% in patients treated by stoppas approach and 58.33% in patients treated with ilioinguinal approach . In a study by shazar et al[37] complications in the ilioinguinal group included 1 iatrogenic nick in the femoral vein, 2 occurrences of major immediate postoperative bleeding (20 units of packed red blood cell), 2 cases of femoral artery thrombosis, and 1 broken guidewire of the cannulated screws. Complications in the modified Stoppas group included 1 patient with secondary fracture displacement.

CLINICAL FOLLOW UP

Quality of reduction was assessed on the basis of Matta's criteria. We observed that patients were equally distributed with respect to displacement in mm among both groups($p>0.05$) and no significant difference was observed among both groups at 3 months , 6 months .

At the end of 4 weeks none of the patients showed weight bearing while in 3 months 50% of patients operated using ilioinguinal approach and 22.2% of patients operated using stoppas approach could bear weight. This difference in ability to bear weight was due to deep seated muscular pain and unable to sit for a long time in stoppas group as compared to the ilioinguinal group .Our results was in accordance to the study by Matta et al [26] as per their conclusion that ilioinguinal

approach was cosmetic , caused minimal ectopic bone formation and provided rapid recovery of the muscles .While at end of 6 months 100% patients in both groups could bear weight. Patients were equally distributed with respect to bearing weight among both groups($p>0.05$). Patients were equally distributed with respect to return to occupation among both groups($p>0.05$).

We observed that patients were equally distributed with respect to pain among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months. However the pain was comparatively less in ilioinguinal approach (4.50±0.90) than stoppas approach (4.33±1.00) . we observed in our study that patients in the stoppas group had deep seated midline abdominal pain which hindered them to sit for a long time .

We observed that patients were equally distributed with respect to ability to walk among both groups($p>0.05$). No significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

We observed that patients were equally distributed with respect to mobility of hip among both groups($p>0.05$). no significant difference was observed among both the groups at 4 weeks , 3 months and 6 months. However at the end of 6 months in ilioinguinal approach the mobility of hip was comparatively more (4.50±1.17 mm) than stoppas approach (4.22±0.83).

The Mean flexion at 6 months was 79.17±24.29 degrees for ilioinguinal group while for stoppas group ,it was 78.89 ±19.65. degrees

The Mean extension at 6 months was 7.08±3.34 degrees for ilioinguinal group while for stoppas group , it was 8.33±5.00 degrees.

The Mean external rotation at 6 months was 29.17± 9 degrees for ilioinguinal group while it was 27.22 ±9.05 degrees for stoppas group

The Mean internal rotation at 6 months was 27.92±8.91 degrees for ilioinguinal group while it was 27.78 ±6.67degrees for stoppas group .

The Mean Adduction at 6 months was 19.17±5.15 degrees for ilioinguinal group while it was 18.89 ±9.28 degrees for stoppas group.

The Mean Abduction at 6 months was 34.17±11.04degrees for ilioinguinal group while it was 31.67 ±11.46 degrees for stoppas group .

We observed that patients were equally distributed with respect to movements at the hip joint among both groups($p>0.05$). No significant difference was observed among both the groups at 4 weeks , 3 months and 6 months.

A study by Elmadag et al[38] showed similar results. They compared the flexion and extension values at the hip joint in patients operated using ilioinguinal and stoppas approach . There was no significant differences between the two groups (flexion $P = 0.678$, extension $P = 0.445$)

Adawy et al[43] in their study reviewed Twelve studies (408 patients) and evaluated clinical outcomes in terms of postoperative fracture reduction using Matta's scale . They observed anatomic reduction (≤ 1 mm) in 290 patients, imperfect reduction (> 1 to < 3 mm) in 77 patients and poor reduction (≥ 3 mm) in 34 patients while anatomic or imperfect reduction in 7 patients.

FUNCTIONAL OUTCOME

The functional outcome following acetabular surgery can be assessed using various hip scores, thereby making comparison between studies easier[52,53] . There are only two series reporting the functional outcome of anterior acetabular fractures. Mears et al[9] used the Harris hip score[54] and reported 72% good to excellent results. In Letournel's series,[52] the modified Merle d'Aubigné and Postel hip score[55] recorded 86% of the fractures having very good to excellent function, which is similar to our study.

According to the modified Merle d'Aubigné score we observed that no significant difference was seen between ilioinguinal approach and stoppas approach regarding the pain , mobility, ability to walk. 66.7% patients had excellent outcome after 6 months in stoppas approach while 75% had excellent outcome after 6 months in ilioinguinal

approach. In a study conducted by Giannoudis et al[48] the outcome was excellent in eight patients of the 26 assessed (30.8%), very good in eight (30.8%), good in six (23.1%) and fair in four (15.4%). Adway et al[43] in their study showed that the mean modified Merle D'Aubinge and Postel score showed an excellent clinical results in patients of modified Stoppas approach(17.7%) especially with anterior column fracture type compared to patients who underwent ilioinguinal approach for the same fracture type(16%) .

RADIOLOGICAL OUTCOME

We observed in our study that Ilioinguinal approach is the mainstay approach for fixation of anterior acetabular fractures (anterior column fractures, anterior wall fractures, anterior column with posterior hemi transverse fractures, most fractures of both columns, partial transverse fractures, and T-type fractures).The drawbacks include the need to mobilize the external iliac neurovascular bundle, the need to open the inguinal canal, and the limited access to the inner aspect of the posterior column and inferior quadrilateral surface. Moreover, the direct visualization of the acetabular articular surface is not possible through the ilioinguinal approach. Consequently, the quality of the articular reduction relies on the quality of cortical osseous reductions of the innominate bone and the confirmation provided by intraoperative fluoroscopy. The complications of the ilioinguinal approach include damage to the external iliac neurovascular bundle, bladder injury, anterior thigh numbness, inguinal hernia, thromboembolism, and infection. Whereas the Stoppas approach gained its significance in fixation of fractures of the anterior acetabulum (anterior column fractures, anterior wall fractures, anterior column with posterior hemi transverse fractures, most fractures of both columns, partial transverse fractures, and T-type fractures). The stoppas approach provided a better surgical view of the inferior quadrilateral plate which provided better fracture reductions.

In their series of 41 cases with at least one year follow up, wherein 23 patients were operated using ilioinguinal approach and 18 patients were operated using Stoppas approach, Hammad et al suggested the advantage of Stoppas approach over and above the ilioinguinal approach for obtaining reduction in both column fractures where a direct buttressing of the quadrilateral plate was required. On the other hand, the ilioinguinal approach, which has an upper hand in obtaining reduction in anterior wall fractures with a more transverse fracture line through use of its middle window.[37,38,59]

In stoppas approach group 100% patient showed fracture union whereas 1 patient in ilioinguinal group showed fracture non union at final follow up. Patients were equally distributed with respect to radiological findings among both groups($p>0.05$). The radiological findings showed that fracture union rate was 91.7% of patients who underwent IIA while it was 100% for patient who underwent stoppas approach.

In a study by Aziz et al[44] according to Matta radiological criteria, reduction quality and final radiological results were not statistically significant for MSA and IIA. But 76.8% patients had excellent to good radiological results in MSA whereas in IIA it was only 58.8% patients.

Meena et al in their study concluded that Acetabular fractures mostly anterior, operated with the modified Stoppas approach achieve better anatomic reduction and low complication rate as compared to ilioinguinal approach. There is no significant difference in intra-operative blood loss between the two groups.[12]

Mahmood et al in their meta-analysis found that in terms of clinical outcomes and complications, no significant differences between the 2 groups.[51]

Thus in present study we conclude that Stoppas approach is more cosmetic surgery in terms of the scar size as compared to the classical ilioinguinal approach . There is no significant difference in respect of complications, intra operative bleeding, radiological and

functional outcomes compared to the ilioinguinal approach. The advantages of the modified Stoppas approach are that bilateral fracture fixation can be done through a single incision and better visualization of the quadrilateral plate is provided.

SUMMARY AND CONCLUSION

The present study was conducted in Department of Orthopaedics in Dayanand Medical College & Hospital, Ludhiana from January 2019 to January 2023 to evaluate and compare Stoppas and Ilioinguinal approach for anterior acetabulum fractures in terms of Anatomical reduction, Complications and Functional outcomes. Total 21 cases were admitted in the department of orthopaedics and those patients who fulfilled the inclusion and exclusion criteria were included in the study. In 12(57.1%) ilioinguinal approach was used while in 9(42.9%) stoppas approach was used.(Table 9).

The mean age of the patient was 44.14±11.18 years with male preponderance. In 17(81%) patients the cause of injury was road side accident while in 4 patients the cause of injury was fall from the height. All acetabulum fractures were classified according to the Letournel and Judet classification. 5 patients(23.8%) presented with anterior column fracture while 6(28.6%) patients presented with anterior column + posterior hemi-transverse fracture while 10 patients (47.6%) presented with associated both column fractures. Hip dislocation was present in 5(23.8%) of the patients. In 14(66.7%) of the patients right side was affected.

No significant differences were seen between surgical approach used and gender, occupation, cause of injury, type of fracture, hip dislocation, laterality, mode of anaesthesia, management and implant used which signifies both groups were comparable with respect to these parameters.

Blood loss in pateints operated using ilioinguinal approach was more as compared to stoppas approach but it was statistically insignificant .

Intra operative complications were seen in 28.57% of patients operated using ilioinguinal approach , 23.8% in patients operated using stoppas approach . Early postoperative complications were seen in 38.09% of patients operated using ilioinguinal approach , 19.04% in patients operated using stoppas approach. Delayed postoperative

complications were seen in 28.57% of patients operated using ilioinguinal approach , 14.28% in patients operated using stoppas approach.

According to the modified Merle d'Aubigné and postel score we observed that no significant difference was seen between ilioinguinal approach and stoppas approach regarding the pain , mobility at the hip joint , ability to walk. 66.7% patients who were operated using stoppas approach had excellent outcome after 6 months while 75% patients operated using ilioinguinal approach had excellent outcome after 6 months .

Patients were equally distributed with respect to radiological union among both groups($p>0.05$). The radiological findings showed that fracture union rate was 91.7% of patients who underwent ilioinguinal approach while it was 100% for patient who underwent stoppas approach.

We have concluded that:

Thus in present study we conclude that Stoppas approach is more cosmetic surgery in terms of the scar size as compared to the classical ilioinguinal approach . There is no significant difference in respect of complications, intra operative bleeding, radiological and functional outcomes compared to the ilioinguinal approach. The advantages of the modified Stoppas approach are that bilateral fracture fixation can be done through a single incision and better visualization of the quadrilateral plate is provided.

BIBLIOGRAPHY

1. Geerts W, Jay R. Pelvis trauma and venous thromboembolism. Fractures of the pelvis and acetabulum.–Lippincott Williams and Williams. 2003;1:80-97.
2. Rahimi H, Gharahdaghi M, Parsa A, Assadian M. Surgical management of acetabular fractures: a case series. Trauma Mon. 2013;18:28-31.
3. Rickman M, Bircher MD. Acetabular fractures in the 21st century. Trauma. 2008;10:149-73.
4. Hoge S, Chauvin BJ. Acetabular Fractures. [Updated 2022 Mar 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK544315/
5. Judet R, Judet J, Letournel E. Fractures of the acetabulum: classification and surgical approaches for open reduction. Preliminary report. J Bone Joint Surg Am. 1964;46:1615-46.
6. Letournel E, Peltier LF, Johnson EE. Fractures of the Acetabulum A Study of a Series of 75 Cases. Clinical Orthopaedics and Related Research (1976-2007). 1994;305:5-9.
7. Anizar-Faizi A, Hisam A, Sudhagar KP, Moganadass M, Suresh C. Outcome of surgical treatment for displaced acetabular fractures. Malays Orthop J.2014;8:1.
8. Mast J, Jakob R, Ganz R. Planning and reduction technique in fracture surgery. Springer Science & Business Media; 2012.
9. Mears DC, Velyvis JH, Chang CP. Displaced acetabular fractures managed operatively: indicators of outcome. Clin Orthop Relat Res. 2003;4:173-86.
10. Wang XJ, Lu Li, Zhang ZH, Su YX, Guo XS, Wei XC, Wei L. Ilioinguinal approach versus Stoppas approach for open reduction and internal fixation in the treatment of displaced acetabular fractures: A systematic review and meta-analysis. Chin J Traumatol. 2017;20:229-34.

11. Stoppas RE, Rives JL, Warlaumont CR, Palot JP, Verhaeghe PJ, Delattre JF. The use of Dacron in the repair of hernias of the groin. Surg Clin North Am. 1984;64:269–85.
12. Meena S, Sharma PK, Mittal S, Sharma J, Chowdhury B. Modified Stoppas Approach versus Ilioinguinal Approach for Anterior Acetabular Fractures; A Systematic Review and Meta-Analysis. Bull Emerg Trauma. 2017;5:6-12.
13. Lawrence DA, Menn K, Baumgaertner M, Haims AH. Acetabular fractures: anatomic and clinical considerations. AJR Am J Roentgenol. 2013 Sep;201(3):W425-36.
14. Hesp WL, Goris RJ. Conservative treatment of fractures of theacetabulum. Results after longtime follow-up. Acta Chir Belg.1988;88:27-32.
15. Ragnarsson B, Jacobsson B. Epidemiology of pelvic fractures in a Swedish county. Acta Orthop Scand. 1992;63(3):297-300.
16. Kalra M, Patralekh MK. Classification of Acetabular fractures. Indian Orthopaedic Association. 2009. https://www.researchgate.net/publication/215560117
17. Vailas JC, Hurwitz SH, Wiesel SW. Posterior acetabular fracture- dislocations: fragment size, joint capsule, and stability. The Journal of trauma. 1989;29:1494-6.
18. Letournel E. The treatment of acetabular fractures through the ilioinguinal approach. Clin Orthop Relat Res. 1993;292:62-76.
19. Matta JM. Operative treatment of acetabular fractures through the ilioinguinal approach: a 10-year perspective. J Orthop Trauma. 2006;20:S20-9.
20. Helfet DL, Borrelli J, Jr., DiPasquale T, Sanders R. Stabilization of acetabular fractures in elderly patients. J Bone Joint Surg Am. 1992;74:753-65.
21. Cole JD, Bolhofner BR. Acetabular fracture fixation via a modified Stoppas limited intrapelvic approach. Description of operative technique and preliminary treatment results. Clin Orthop Relat Res. 1994;305:112-23.

22. Kacra BK, Arazi M, Cicekcibasi AE, Buyukmumcu M, Demirci S. Modified medial Stoppas approach for acetabular fractures: an anatomic study. JTrauma. 2011;71:1340-4.
23. Tosounidis TH, Gudipati S, Panteli M, Kanakaris NK, Giannoudis PV. The use of buttress plates in the management of acetabular fractures with quadrilateral plate involvement: is it still a valid option? Int Orthop. 2015;39:2219-26.
24. Letournel E. Acetabulum fractures: classification and management. Clin Orthop Relat Res. 1980;151:81-106.
25. Matta JM, Merritt PO. Displaced acetabular fractures. Clin Orthop Relat Res. 1988;230:83-97.
26. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. J Bone Joint Surg Am. 1996;78:1632-45.
27. Ochs BG, Marintschev I, Hoyer H, Rolauffs B, Culemann U, Pohlemann T, et al. Changes in the treatment of acetabular fractures over 15 years: analysis of 1,266 cases treated by the German Pelvic Multicentre Study Group (DAO/DGU). Injury. 2010;41:839-51.
28. Kloen P, Siebenrock KA, Ganz R. Modification of the ilioinguinal approach. J Orthop Trauma. 2002;16:586-93.
29. Soni A, Gupta R, Sen R. Modified Stoppas Approach for Acetabulum Fracture: A Review. Rev Bras Ortop (Sao Paulo). 2019;54:109-117.
30. Rives J, Stoppas R, Fortesa L, Nicaise H. [Dacron patches and their place in surgery of groin hernia. 65 cases collected from a complete series of 274 hernia operations]. Ann Chir 1968;22:159–171
31. Hirvensalo E, Lindahl J, Böstman O. A new approach to the internal fixation of unstable pelvic fractures. Clin Orthop Relat Res. 1993;297:28-32
32. Yao S, Chen K, Ji Y, Zhu F, Zeng L, Xiong Z, et al. Supra-ilioinguinal versus modified Stoppas approach in the treatment of acetabular fractures: reduction quality and early clinical

results of a retrospective study. J Orthop Surg Res. 2019;14:364.

33. Liu Y, Yang H, Li X, Yang SH, Lin JH. Newly modified Stoppas approach for acetabular fractures. Int Orthop. 2013;37:1347-53.
34. Taller S, Srám J, Lukás R, Krivohlávek M. Zlomeniny pánevního kruhu a acetabula operované prístupem podle Stoppy [Surgical treatment of pelvic ring and acetabular fractures using the Stoppas approach]. Acta Chir Orthop Traumatol Cech. 2010;77:93-8.
35. Bastian JD, Tannast M, Siebenrock KA, Keel MJ. Mid-term results in relation to age and analysis of predictive factors after fixation of acetabular fractures using the modified Stoppas approach. Injury. 2013;44:1793-8.
36. Ma K, Luan F, Wang X, Ao Y, Liang Y, Fang Y, et al. Randomized, controlled trial of the modified Stoppas versus the ilioinguinal approach for acetabular fractures. Orthopedics. 2013;36:1307-15.
37. Shazar N, Eshed I, Ackshota N, Hershkovich O, Khazanov A, Herman A.Comparison of acetabular fracture reduction quality by the ilioinguinal orthe anterior intrapelvic (modified Rives-Stoppas) surgical approaches. JOrthop Trauma. 2014;28:313–9.
38. Elmadağ M, Güzel Y, Acar MA, Uzer G, Arazi M. The Stoppas approach versus the ilioinguinal approach for anterior acetabular fractures: a case control study assessing blood loss complications and function outcomes. Orthop Traumatol Surg Res. 2014;100:675-80.
39. Kilinc CY, Acan AE, Gultac E, Kilinc RM, Hapa O, Aydogan NH. Treatment results for acetabulum fractures using the modified Stoppas approach. Acta Orthop Traumatol Turc. 2019;53:6-14.
40. Halwai MA, Manzoor QW, Wani MI, Mir BA. The epidemiology and fracture patterns of acetabular fractures in a tertiary care centre of North India: A hospital based study. ISSN: 2395-1958 IJOS 2019;5:18-21.

41. Kadam R, Dagar PS, Challani A, Jadhav A, Pestonji J. Functional outcome of acetabular fracture fixation by modified Stoppas approach . Int J Res Orthop 2019;5:177-81.
42. Wu H, Zhang L, Guo X, Jiang X. Meta-analysis of modified Stoppas approach and ilioinguinal approach in anterior pelvic ring and acetabular fractures. Medicine (Baltimore). 2020;99:e18395.
43. Al Adawy AS, Aziz AHA, El Sherief FA, Mahmoud WS, Mabrook M, Hassan YE. Modified Stoppas as an alternative surgical approach for fixation of anterior fracture acetabulum: a randomized control clinical trial. J Orthop Surg Res. 2020;15:154.
44. Aziz AMA, Sonkawade VD, Santpure S. Comparative study of modified Stoppas approach and ilioinguinal approach for pelviacetabular fractures. Int J Res Orthop 2020;6:1070-6.
45. Ziran N, Soles GLS, Matta JM. Outcomes after surgical treatment of acetabular fractures: a review. Patient Saf Surg. 2019;13:16.
46. Kadirvelu SK, Narayanaswamy B, Kalamegam A. Retrospective study on outcome of surgical management of acetabular fracture. J Evid Based Med Healthc. 2016;3:4964-74.
47. Trikha V, V G, Cabrera D, Bansal H, Mittal S, Sharma V. Epidemiological assessment of acetabular fractures in a level one trauma centre: A 7-Year observational study. J Clin Orthop Trauma. 2020;11:1104-1109.
48. Giannoudis PV, Kanakaris NK, Dimitriou R, Mallina R, Smith RM. The surgical treatment of anterior column and anterior wall acetabular fractures: short- to medium-term outcome. J Bone Joint Surg Br. 2011;93:970-4.
49. Alzahhar MS, Montaser MG, Tabl EA, Abd-Allah SA. A Systematic Review on Management of Anterior Column Acetabular Fracture. BJAS. 2020;5:67-71.
50. Cavalcante MC, de Arruda FAA, Boni G, Sanchez GT, Balbachevsky D, Dos Reis FB. Demographic analysis of

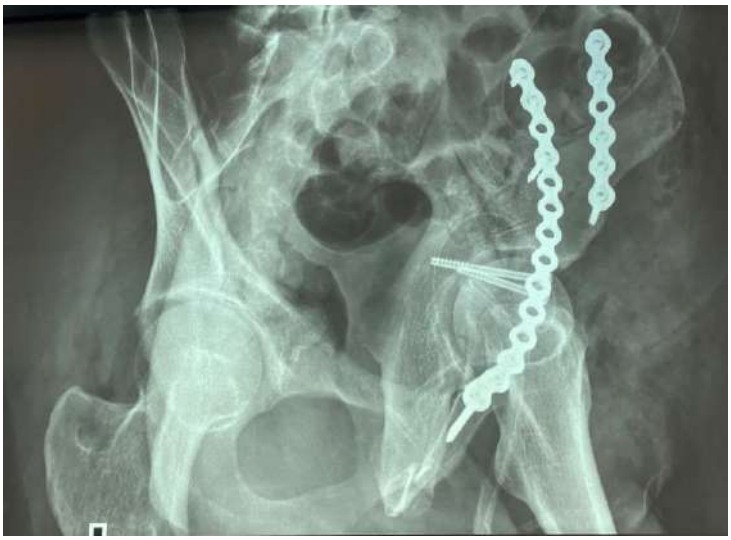
acetabular fractures treated in a quaternary care hospital from 2005 to 2016. Acta Ortop Bras. 2019;27:317-20.

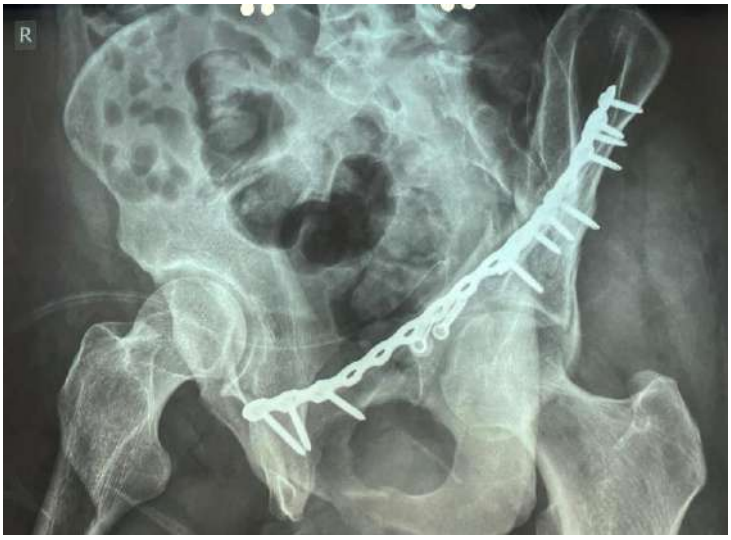
51. Mahmood K, Darshan MS, Maley DK, Delair AI, Baig R. A meta-analysis of modified Stoppas approach and ilioinguinal approach in open reduction and internal fixation of Pelviacetabular fractures. International Journal of Orthopaedics. 2020;6:832-7.
52. Letournel E, Judet R. Operative treatment of specific types of fracture. In: Elson RA, ed. Fractures of the acetabulum. Second ed. Berlin: Springer-Verlag, 1993:428–36.
53. Madhu R, Kotnis R, Al-Mousawi A, Barlow N, Deo S, Worlock P, Willett K. Outcome of surgery for reconstruction of fractures of the acetabulum. The time dependent effect of delay. J Bone Joint Surg Br. 2006;88:1197-203.
54. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am. 1969;51:737-55.
55. D'AUBIGNE RM, POSTEL M. Functional results of hip arthroplasty with acrylic prosthesis. J Bone Joint Surg Am. 1954;36:451-75.
56. Tosounidis TH, Giannoudis VP, Kanakaris NK, Giannoudis PV. The Ilioinguinal Approach: State of the Art. JBJS Essent Surg Tech. 2018;8:e19.
57. Stoppas RE, Rives JL, Warlaumont CR, Palot JP, Verhaeghe PJ, Delattre JF. The use of Dacron in the repair of hernias of the groin. *Surg Clin North Am.* 1984;64:269–85.
58. Hirvensalo E, Lindahl J, Kiljunen V. Modified and new approaches for pelvic and acetabular surgery. *Injury.* 2007;38:431–41.
59. Hammad AS, El-Khadrawe TA. Accuracy of reduction and early clinical outcome in acetabular fractures treated by the standard ilio-inguinal versus the Stoppas/iliac approaches. Injury. 2015;46:320-6.

CASE- I

PRE - OP

POST - OP



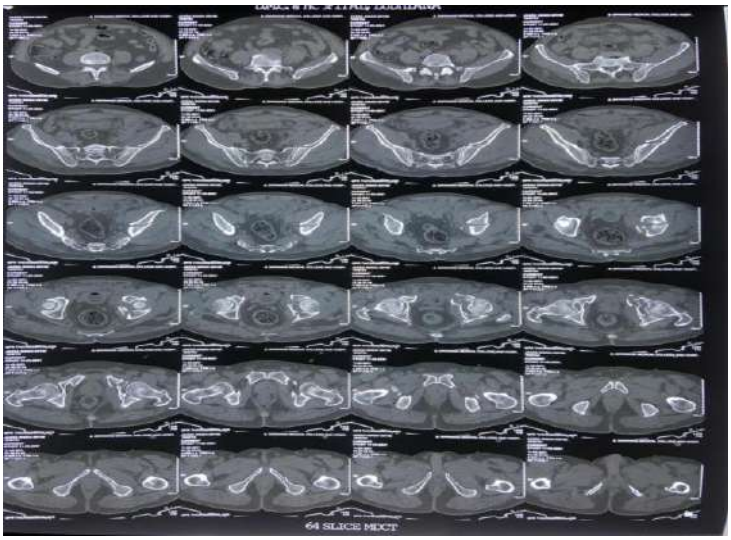


FINAL FOLLOW-UP

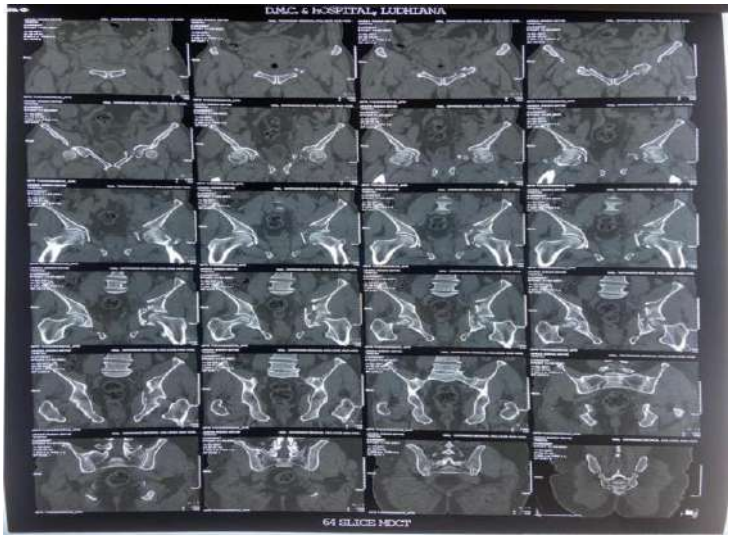
CASE- II

PRE-OP

PRE-OP CT

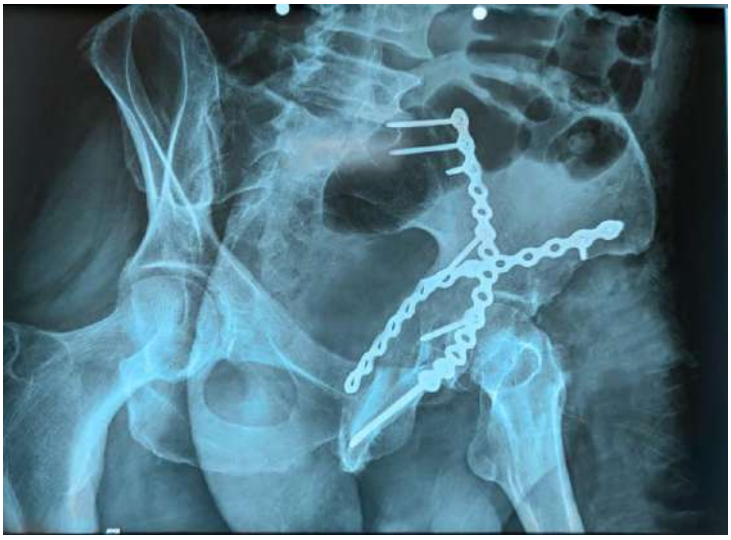

64 SLICE MDCT

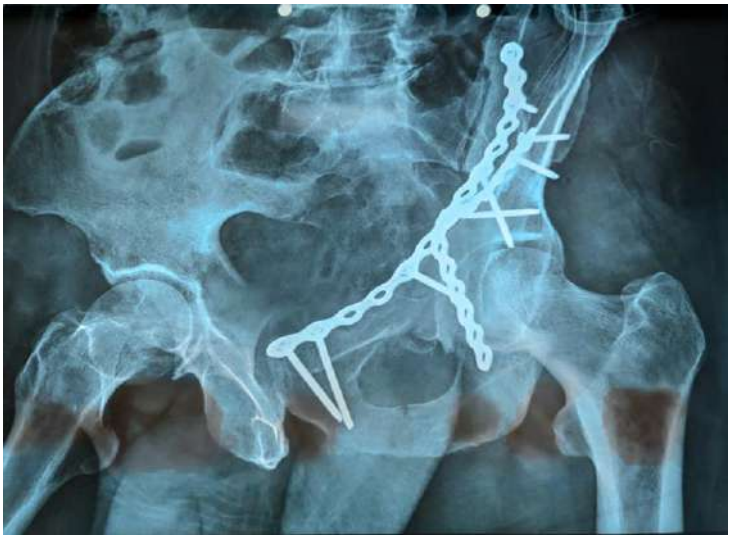
D.M.C. & HOSPITAL, LUDHIANA


D.M.C. & HOSPITAL, LUDHIANA
64 SLICE MDCT

POST-OP

FINAL FOLLOW-UP

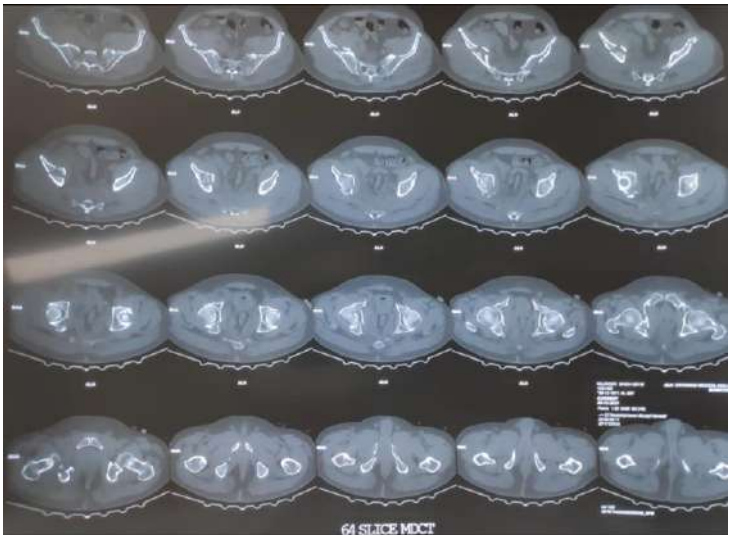


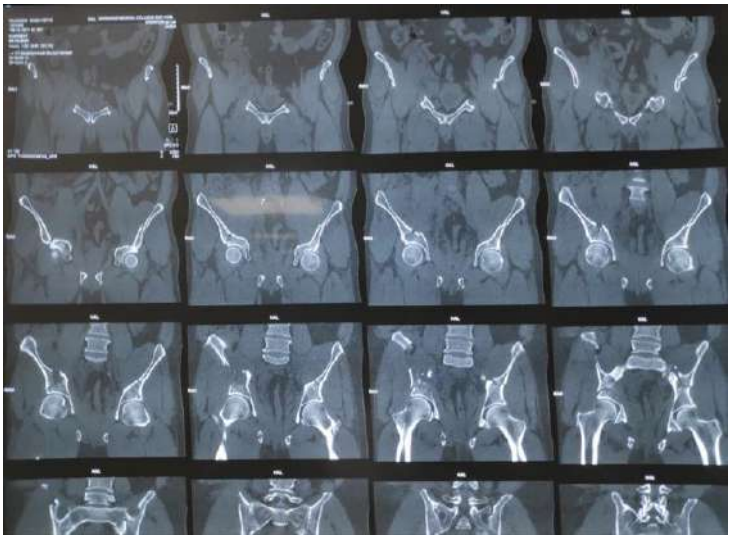


CASE- III

PRE-OP

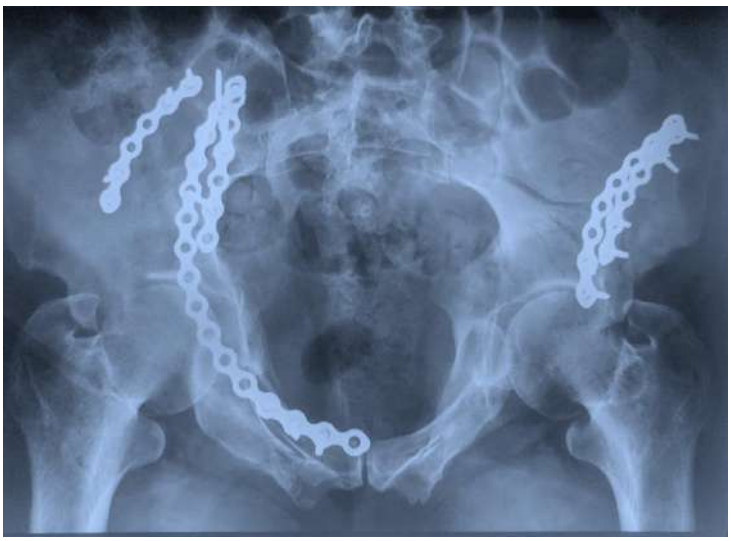
PRE-OP CT





POST-OP

FINAL FOLLOW-UP

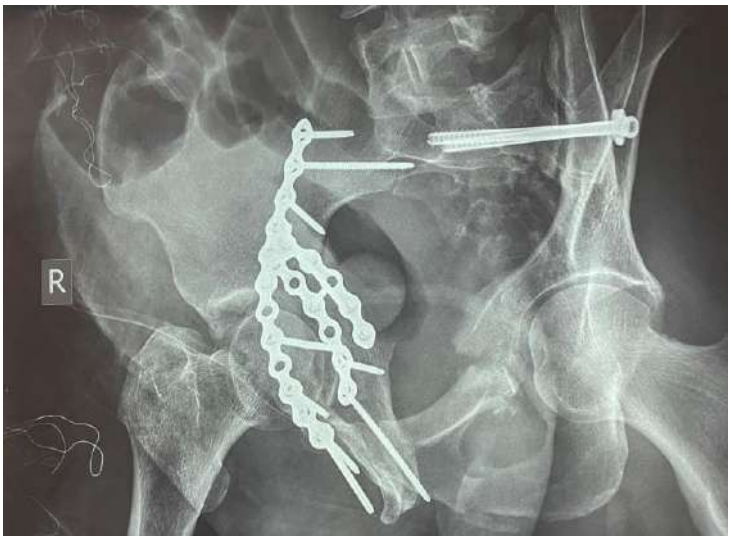


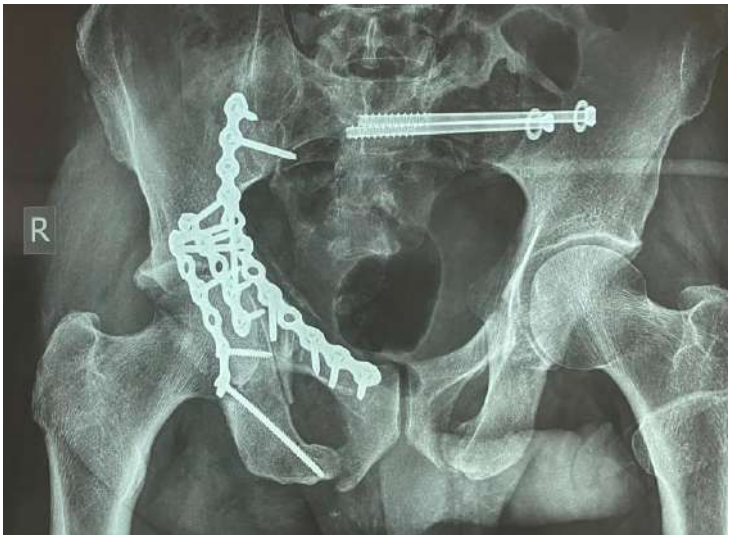
CASE-IV

PRE-OP

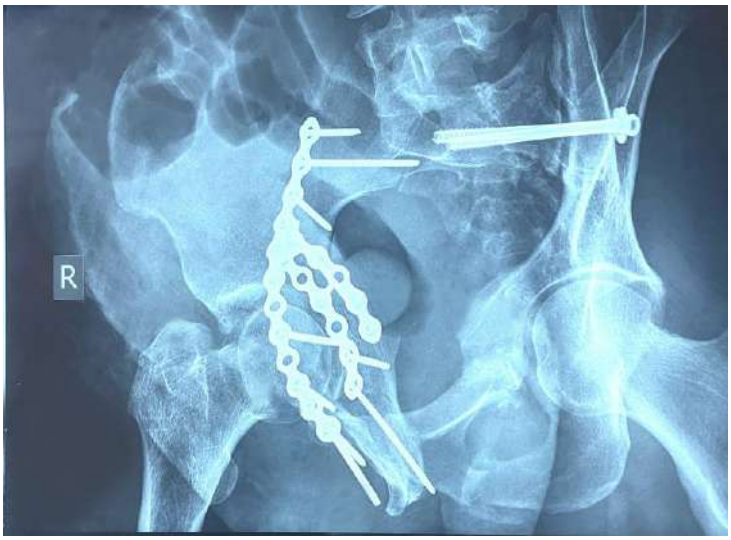
PRE-OP CT

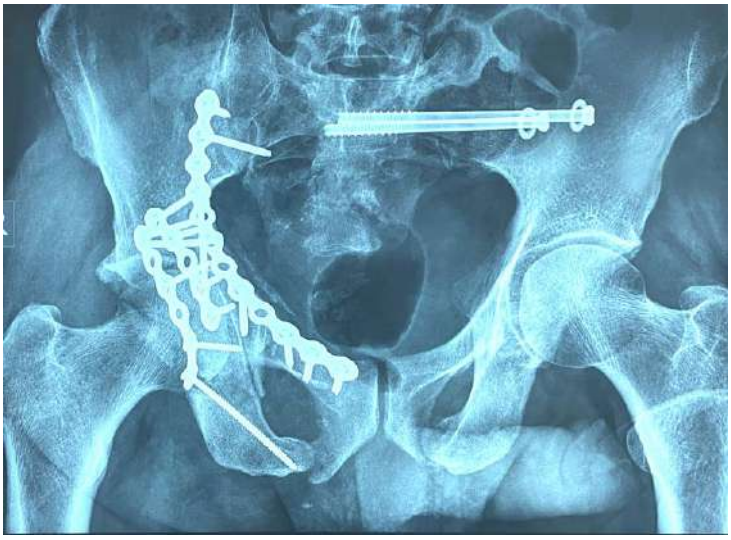
POST-OP





FINAL FOLLOW-UP





PROFORMA

S.NO

NAME

AGE/ SEX

MRD NO

ADMISSION NO

DATE OF ADMISSION

DATE OF DISCHARGE

RELIGION

OCCUPATION

DATE OF INJURY

MODE OF INJURY: ROAD SIDE ACCIDENT / MOTOR VEHICLE ACCIDENT

EMPLOYMENT STATUS - WORKING / NOT WORKING

LOCAL EXAMINATION -

- OPEN / CLOSED FRACTURE
- XRAY FINDING

FRACTURE CLASSIFICATION
SITE OF FRACTURE
HIP DISLOCATION

Signature of Candidate **Signature of Supervisor**

OPERATION / PROCEDURE

ANAESTHESIA USED- GENERAL ANAESTHESIA/ SPINAL ANAETHESIA

DATE OF SURGERY

SURGICAL APPROACH USED

IMPLANT TYPE – INDIAN/ IMPORTED

TIME OF SURGERY

LESS THAN 1 HOUR	
1-2 HRS	
> 2 HRS	

BLOOD LOSS-

<500 ML	
500-1000ML	
1000-1500 ML	
> 1500 ML	

COMPLICATIONS-

- INTRA OPERATIVE
- POST OPERATIVE
- DELAYED

Signature of Candidate

Signature of Supervisor

FOLLOW UP-

- RADIOLOGICAL UNION –

ANATOMICAL REDUCTION	4 WEEKS	3 MONTHS	6 MONTHS
<1MM DISPLACEMENT			
2-3 MM DISPLACEMENT			
>3MM DISPLACEMENT			

Follow up by Merle d' Aubigne and Postel Method

Parameters	4 weeks	3 months	6 months
Mobility of the hip			
Pain			
Ability to walk			

Signature of Candidate **Signature of Supervisor**

CRITERIA FOR FUNCTIONAL EVALUATION

Merle d' Aubigne and Postel Method

SCORE	PAIN	MOBILITY	ABILITY TO WALK
0	Pain is intense and permanent	Ankylosis in abnormal position	Impossible
1	Pain is severe, disturbing sleep	Ankylosis in normal position or in a very slight abnormal position	Only with crutches
2	Pain is severe when walking , prevents any activity	Flexion <40 degrees(abduction =0 degrees)or a very light joint deformity	Only with two canes
3	Pain is severe but may be tolerated with limited activity	Flexion <40- 60 degees	Limited with one cane (less than 1 hour). Very difficult without a cane
4	Pain only after walking and dissapearing with rest	Flexion > 60 -80 degrees (can tie shoelaces)	Prolonged with one cane , limited without cane (limp)
5	Very little pain and intermittent and does not preclude normal activity	Flexion >80- 90 degrees Limited abduction (>25degrees)	Without a cane but slight limp
6	No pain at all	Normal flexion >90 degrees , Abduction>25 degrees	Normal

Signature of Candidate

Signature of Supervisor

KEY TO MASTER CHART

M	MALE
F	FEMALE
RSA	ROAD SIDE ACCIDENT
ORIF	OPEN REDUCTION AND INTERNAL FIXATION
CSE	COMBINED SPINAL EPIDURAL
AVN	AVASCULAR NECROSIS
CC	CANNULATED CANCELLOUS

S.NO	NAME	AGE (YEARS)	SEX	MRD NO	DATE OF ADMISSION	DATE OF DISCHARGE	RELIGION	OCCUPATION	DATE OF INJURY	MODE OF INJURY	EMPLOYMENT STATUS	OPEN / CLOSED FRACTURE	LOCAL EXAMINATION
											WORKING \ NOT WORKING		XRAY FINDING
													FRACTURE CLASSIFICATION (LETOURNEL -JUDET)
1	ER	35	F	1084330	12-04-2021	18-04-2021	HINDUISM	HOUSE WIFE	12-04-2021	FALL FROM HEIGHT	NOT WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
2	MS	65	M	979658	24-10-2020	04-11-2020	SIKHISM	FARMER	23-10-2020	RSA	NOT WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
3	HS	33	M	968256	23-09-2020	28-09-2020	SIKHISM	FARMER	22-09-2020	RSA	WORKING	CLOSED	ASSOCIATED BOTH COLUMN
4	BS	54	M	1034293	03-03-2021	11-03-2021	SIKHISM	FARMER	02-03-2021	RSA	NOT WORKING	CLOSED	ANTERIOR COLUMN
5	JS	60	M	1048754	11-03-2021	22-03-2021	SIKHISM	FARMER	10-03-2021	RSA	NOT WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
6	SS	53	M	988741	18-11-2020	26-11-2020	SIKHISM	FARMER	17-11-2020	RSA	WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
7	AS	30	M	1016924	23-01-2021	04-02-2021	SIKHISM	COMMANDO	23-01-2021	RSA	WORKING	CLOSED	ASSOCIATED BOTH COLUMN
8	SB	46	F	1102168	03-05-2021	31-05-2021	HINDUISM	HOUSE WIFE	02-05-2021	RSA	NOT WORKING	CLOSED	ASSOCIATED BOTH COLUMN
9	JU	37	F	1119008	06-06-2021	14-06-2021	HINDUISM	HOUSE WIFE	01-06-2021	FALL FROM HEIGHT	NOT WORKING	CLOSED	ASSOCIATED BOTH COLUMN
10	GS	42	M	1194419	20-10-2021	31-10-2021	SIKHISM	GOVT.EMPLOYEE	20-10-2021	RSA	WORKING	CLOSED	ASSOCIATED BOTH COLUMN
11	JS	46	M	1197264	25-10-2021	08-11-2021	SIKHISM	BUSINESSMAN	24-10-2021	RSA	WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
12	RS	50	M	1221450	15-12-2021	25-12-2021	SIKHISM	FARMER	15-12-2021	RSA	WORKING	CLOSED	ANTERIOR COLUMN
13	PR	40	F	1237694	11-01-2022	12-02-2022	HINDUISM	HOUSE WIFE	11-01-2022	RSA	NOT WORKING	CLOSED	ASSOCIATED BOTH COLUMN
14	RS	43	M	1270433	16-03-2022	22-03-2022	SIKHISM	DRIVER	15-03-2022	FALL FROM HEIGHT	WORKING	CLOSED	ASSOCIATED BOTH COLUMN

S.NO	HIP DISLOCATION	SITE OF FRACTURE	OPERATION / PROCEDURE	GENERAL ANAESTHESIA /SPINAL ANAESTHESIA /CSE	DATE OF SURGERY	SURGICAL APPROACH USED	IMPLANT TYPE	TIME OF SURGERY (HOURS)	BLOOD LOSS	COMPLICATIONS		
							INDIAN/ IMPORTED			INTRA OPERATIVE	POST OPERATIVE (<72hours)	DELAYED
1	ABSENT	RIGHT SIDE	ORIF WITH 3 RC PLATES	CSE	15-04-2021	ILIONGUINAL APPROACH	IMPORTED	4	<500 ML	NONE	HYPOTENSION	NONE
2	ABSENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	CSE	31-10-2020	ILIONGUINAL APPROACH	IMPORTED	3.5	500-1000ML	HYPOVOLEMIC SHOCK	NONE	NONE
3	PRESENT	LEFT SIDE	ORIF WITH 2 RC PLATES AND 2 CC SCREWS	CSE	24-09-2020	STOPPAS	IMPORTED	5	500-1000ML	NONE	HIGH GRADE FEVER	NONE
4	ABSENT	LEFT SIDE	ORIF WITH 1 RC PLATE AND 2 CC SCREWS	CSE	03-03-2021	STOPPAS	IMPORTED	3	500-1000ML	BRADYCARDIA , HYPOVOLEMIC SHOCK	INTENSE PAIN	HERNIA FORMATION
5	ABSENT	LEFT SIDE	ORIF WITH 2 RC PLATES	CSE	15-03-2021	STOPPAS	IMPORTED	4.5	500-1000ML	NONE	NONE	NONE
6	ABSENT	LEFT SIDE	ORIF WITH 2 RC PLATES	CSE	18-11-2020	STOPPAS	IMPORTED	3.5	500-1000ML	NONE	NONE	NONE
7	PRESENT	RIGHT SIDE	ORIF WITH 3 RC PLATES	CSE	27-01-2021	ILIONGUINAL APPROACH	IMPORTED	4.5	1000-1500 ML	HYPOVOLEMIC SHOCK, INJURY TO LATERAL CUTANEOUS NERVE OF THIGH	HYPOVOLEMIC SHOCK	NONE
8	ABSENT	RIGHT SIDE	ORIF WITH 1 RC PLATE	GENERAL	22-05-2021	ILIONGUINAL APPROACH	INDIAN	3	500-1000ML	LOSS OF REDUCTION	NONE	NONE
9	PRESENT	RIGHT SIDE	ORIF WITH 1 RC PLATE AND 2 CC SCREWS	GENERAL	09-06-2021	ILIONGUINAL APPROACH	IMPORTED	5	500-1000ML	NONE	NONE	POST TRAUMATIC ARTHRITIS
10	ABSENT	LEFT SIDE	ORIF WITH 3 RC PLATES	CSE	23-10-2021	ILIONGUINAL APPROACH	IMPORTED	4	500-1000ML	NONE	HIGH GRADE FEVER	NONE
11	ABSENT	LEFT SIDE	ORIF WITH 3 RC PLATES	CSE	30-10-2021	STOPPAS	IMPORTED	3.5	<500 ML	NONE	DISCHARGE FROM SUTURE LINE	PERSISTANT PAIN
12	ABSENT	RIGHT SIDE	ORIF WITH 3 RC PLATES	CSE	16-12-2021	ILIONGUINAL APPROACH	IMPORTED	4.5	500-1000ML	NONE	HYPOTENSION	PERSISTANT PAIN
13	ABSENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	GENERAL	19-01-2022	STOPPAS	INDIAN	3.5	500-1000ML	HYPOVOLEMIC SHOCK	NONE	NONE
14	PRESENT	RIGHT SIDE	ORIF WITH 3 RC PLATES	CSE	21-03-2022	ILIONGUINAL APPROACH	IMPORTED	2.5	1000-1500 ML	INJURY TO LATERAL CUTANEOUS NERVE OF THIGH	HYPOTENSION,	STIFFNESS OF HIP JOINT

S.NO	FOLLOW UP			FOLLOW UP	RANGE OF MOTION AT THE HIP JOINT														
	RADIOLOGICAL UNION			RADIOLOGICAL UNION	FLEXION			EXTENTION			EXTERNAL ROTATION			INTERNAL ROTATION			ADDUCTION		
	4 WEEKS	3 MONTHS	6 MONTHS																
	DISPLACEMENT IN MM	DISPLACEMENT IN MM	DISPLACEMENT IN MM		4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS
1	2-3MM	2-3MM	<1MM	UNITED	60	80	100	5	10	10	20	30	30	30	30	30	20	30	30
2	2-3MM	2-3MM	2-3MM	UNITED	30	60	70	0	5	5	10	20	20	15	20	30	10	10	20
3	2-3MM	2-3MM	2-3MM	UNITED	45	60	80	0	5	5	15	20	30	20	20	20	10	20	30
4	2-3MM	2-3MM	<1MM	UNITED	30	50	70	0	5	5	10	10	15	20	30	30	10	10	10
5	2-3MM	2-3MM	2-3MM	UNITED	30	40	50	5	5	5	10	20	20	20	30	30	0	10	10
6	2-3MM	2-3MM	2-3MM	UNITED	70	110	110	5	10	20	30	40	40	40	40	40	20	20	30
7	>3MM	>3MM	2-3MM	UNITED	60	80	100	0	5	15	10	30	40	40	40	40	20	20	20
8	>3MM	>3MM	2-3MM	NON UNITED	30	45	80	0	10	10	15	15	10	0	10	15	0	10	10
9	2-3MM	2-3MM	2-3MM	UNITED	45	60	80	5	5	5	20	20	30	20	30	30	10	20	20
10	2-3MM	2-3MM	2-3MM	UNITED	60	70	90	5	5	5	15	30	30	20	30	30	10	10	10
11	2-3MM	2-3MM	2-3MM	UNITED	60	70	90	5	5	10	20	20	20	10	30	30	10	10	20
12	>3MM	>3MM	>3MM	UNITED	70	90	120	5	5	5	15	40	40	30	40	40	20	20	20
13	2-3MM	2-3MM	2-3MM	UNITED	30	45	50	0	0	5	10	30	30	30	30	30	20	30	30
14	2-3MM	2-3MM	2-3MM	UNITED	45	60	90	0	5	5	10	30	30	0	10	10	10	20	20

S.NO				FUNCTION TO PREINJURY LEVEL						FOLLOW UP BY Merle d' Aubigne and Postel Method									Merle d' Aubigne and Postel SCORE AT FINAL FOLLOW UP
	ABDUCTION			WEIGHT BEARING			RETURN TO OCCUPATION			MOBILITY OF HIP JOINT			PAIN			ABILITY TO WALK			
	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	
1	30	40	40	NO	YES	YES	NO	NO	YES	4	4	6	4	4	5	2	4	5	16
2	20	20	45	NO	NO	YES	NO	YES	YES	3	5	5	3	4	5	2	3	5	15
3	20	20	30	NO	NO	YES	NO	NO	NO	3	4	4	1	4	4	0	2	3	11
4	30	30	40	NO	NO	YES	NO	YES	YES	2	3	5	2	4	5	0	2	4	14
5	0	10	20	NO	NO	YES	NO	NO	NO	2	3	3	2	3	3	1	3	4	10
6	30	30	45	NO	YES	YES	NO	NO	YES	3	4	5	3	3	5	0	2	5	15
7	20	30	30	NO	YES	YES	NO	NO	NO	2	2	4	1	1	3	0	1	3	10
8	20	40	40	NO	NO	YES	NO	NO	NO	2	2	2	1	2	3	0	0	4	9
9	0	10	20	NO	NO	YES	NO	NO	YES	1	3	5	1	4	5	0	2	4	14
10	5	15	35	NO	YES	YES	NO	NO	YES	2	3	5	2	4	5	2	4	5	15
11	20	30	30	NO	NO	YES	NO	NO	YES	2	3	5	3	4	4	1	3	5	14
12	30	30	45	NO	YES	YES	NO	YES	YES	2	3	5	2	3	5	2	3	5	15
13	30	40	45	NO	NO	YES	NO	NO	YES	2	4	5	3	4	4	2	4	5	14
14	40	40	45	NO	YES	YES	NO	NO	YES	2	4	5	2	4	5	1	3	5	15

S.NO	NAME	AGE (YEARS)	SEX	MRD NO	DATE OF ADMISSION	DATE OF DISCHARGE	RELIGION	OCCUPATION	DATE OF INJURY	MODE OF INJURY	EMPLOYMENT STATUS	OPEN / CLOSED FRACTURE	LOCAL EXAMINATION
											WORKING \ NOT WORKING		XRAY FINDING
													FRACTURE CLASSIFICATION (LETOURNEL -JUDET)
15	HA	32	F	1091833	14-01-2022	29-01-2022	HINDUISM	HOUSE WIFE	14-01-2022	RSA	NOT WORKING	CLOSED	ANTERIOR COLUMN
16	MS	32	M	1356591	08-03-2022	17-03-2022	SIKHISM	FARMER	08-03-2022	RSA	WORKING	CLOSED	ASSOCIATED BOTH COLUMN
17	PL	54	M	874907	01-01-2020	16-01-2020	HINDUISM	CARPENTER	01-01-2020	RSA	WORKING	CLOSED	ANTERIOR COLUMN + POSTERIOR HEMITRANSVERSE
18	AS	41	M	986294	12-11-2020	02-12-2020	SIKHISM	BUSINESSMAN	12-11-2020	RSA	WORKING	CLOSED	ANTERIOR COLUMN
19	HS	49	M	984741	15-11-2021	22-11-2021	SIKHISM	DRIVER	15-11-2021	FALL FROM HEIGHT	WORKING	CLOSED	ASSOCIATED BOTH COLUMN
20	GS	24	M	978927	21-10-2020	26-10-2020	SIKHISM	FARMER	21-10-2020	RSA	NOT WORKING	CLOSED	ANTERIOR COLUMN
21	BS	61	M	974057	12-04-2022	18-04-2022	SIKHISM	FARMER	12-04-2022	RSA	NOT WORKING	CLOSED	ASSOCIATED BOTH COLUMN

S.NO	HIP DISLOCATION	SITE OF FRACTURE	OPERATION / PROCEDURE	GENERAL ANAESTHESIA /SPINAL ANAESTHESIA /CSE	DATE OF SURGERY	SURGICAL APPROACH USED	IMPLANT TYPE	TIME OF SURGERY (HOURS)	BLOOD LOSS	COMPLICATIONS		
							INDIAN/ IMPORTED			INTRA OPERATIVE	POST OPERATIVE (<72hours)	DELAYED
15	ABSENT	RIGHT SIDE	ORIF WITH 1 RC PLATE	CSE	20-01-2022	STOPPAS	INDIAN	5	500-1000ML	NONE	NONE	NONE
16	ABSENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	CSE	09-03-2022	ILIONGUINAL APPROACH	IMPORTED	4	500-1000ML	NONE	NONE	NONE
17	ABSENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	CSE	09-01-2020	STOPPAS	IMPORTED	3.5	1000-1500 ML	LOSS OF REDUCTION, TACHYCARDIA	NONE	NONE
18	ABSENT	RIGHT SIDE	ORIF WITH 1 RC PLATE	GENERAL	20-11-2020	ILIONGUINAL APPROACH	IMPORTED	2.5	1000-1500 ML	NONE	NONE	AVN HIPJOINT
19	ABSENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	GENERAL	17-11-2021	STOPPAS	INDIAN	3.5	500-1000ML	NONE	DEEP TISSUE INFECTION	POST TRAUMATIC ARTHRITIS
20	ABSENT	LEFT SIDE	ORIF WITH 1 RC PLATE	GENERAL	23-10-2020	ILIONGUINAL APPROACH	INDIAN	4	500-1000ML	NONE	DISCHARGE FROM SUTURE LINE , HEMATOMA FORMATION	AVN HIP JOINT
21	PRESENT	RIGHT SIDE	ORIF WITH 2 RC PLATES	CSE	12-10-2020	ILIONGUINAL APPROACH	IMPORTED	5	>1500ML	HYPOVOLEMIC SHOCK	HYPOTENSION	STIFFNESS OF HIP JOINT

S.NO	FOLLOW UP			FOLLOW UP	RANGE OF MOTION AT THE HIP JOINT														
	RADIOLOGICAL UNION			RADIOLOGICAL UNION	FLEXION			EXTENTION			EXTERNAL ROTATION			INTERNAL ROTATION			ADDUCTION		
	4 WEEKS	3 MONTHS	6 MONTHS																
	DISPLACEMENT IN MM	DISPLACEMENT IN MM	DISPLACEMENT IN MM		4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS
15	2-3MM	2-3MM	2-3MM	UNITED	45	70	90	0	5	10	30	30	40	20	20	20	5	10	10
16	>3MM	2-3MM	2-3MM	UNITED	20	35	50	5	5	5	20	30	30	20	30	30	10	20	20
17	>3MM	2-3MM	2-3MM	UNITED	40	60	90	5	10	10	15	20	20	10	30	30	10	10	20
18	>3MM	2-3MM	2-3MM	UNITED	20	30	30	5	5	5	15	15	20	20	30	30	10	10	20
19	>3MM	2-3MM	2-3MM	UNITED	50	60	80	5	5	5	10	20	30	15	20	20	0	10	10
20	2-3MM	2-3MM	2-3MM	UNITED	45	60	60	5	10	10	10	20	30	15	20	20	10	20	20
21	>3	2-3MM	2-3MM	UNITED	20	50	80	0	5	5	15	20	40	20	20	30	20	20	20

S.NO	ABDUCTION			FUNCTION TO PREINJURY LEVEL						FOLLOW UP BY Merle d' Aubigne and Postel Method									Merle d' Aubigne and Postel SCORE AT FINAL FOLLOW UP
				WEIGHT BEARING			RETURN TO OCCUPATION			MOBILITY OF HIP JOINT			PAIN			ABILITY TO WALK			
	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	4 WEEKS	3 MONTHS	6 MONTHS	
15	30	30	35	NO	NO	YES	NO	NO	YES	2	3	4	2	4	6	3	4	6	16
16	30	30	30	NO	NO	YES	NO	NO	YES	3	3	4	3	4	4	3	4	4	12
17	10	20	30	NO	YES	YES	NO	NO	YES	2	3	4	2	4	5	2	4	4	13
18	20	20	20	NO	NO	YES	NO	NO	YES	2	4	4	3	4	4	2	4	4	12
19	0	10	10	NO	NO	YES	NO	NO	NO	2	2	3	2	3	3	2	3	3	9
20	20	20	15	NO	NO	YES	NO	NO	NO	3	3	3	3	4	4	3	3	3	10
21	30	30	45	NO	YES	YES	NO	NO	YES	3	4	6	3	3	6	3	4	6	18

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb), INDIA.
Phone : 01639-256232,256236
Tele/Fax : 01639-256235
Email : Examination@bfuhs.ac.in

No. BFUHS/2K21p-TH/ 11-7 Date 04-11-21

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Sahil Sahota**, a student of your college for **MS Orthopaedics** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
To study the outcome of anterior acetabulum fractures using stoppas and ilioinguinal approach.

Supervisor
Dr. Rajnish Garg
Prof. & Head,
Dept. of Orthopaedics,
DMCH, Ludhiana.

Co-Supervisor

Dr. Shekhar Singal
Assoc. Prof.,
Dept. of Orthopaedics,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

145. If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.

146. The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.

TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SURGERY

IN

ORTHOPAEDICS

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH, 2021

DR. SAHIL SAHOTA

DEPARTMENT OF ORTHOPAEDICS
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH
For the degree of	M.S. Orthopaedics
Name of the candidate	Dr. Sahil Sahota
Supervisor	Dr. Rajnish Garg, Professor & Head, Department of Orthopaedics, DMC&H Ludhiana
Co-supervisor	Dr. Shekhar Singhal, Associate Professor, Department of Orthopaedics, DMC&H Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Acetabulum fractures are among the most serious injuries treated by orthopedic surgeons. Injury to the acetabulum is almost always associated with soft tissues, neurovascular as well as abdominal viscera, urinary bladder and urethral injuries. These complex injuries need multidisciplinary approach for the management in the tertiary health centres.

Aim of Study: This study aims to analyse and compare Stoppas and Ilioinguinal approach for anterior acetabulum fractures in terms of anatomical reduction, functional outcomes and complications.

Material & Methods: A proforma will be filled at the start of the study for retrospective patients from the patient charts in the record room and department of orthopedics and for the prospective patients at the time of admission; from 1st January 2019 to 1st August 2022.

Clinical Significance: The acetabular injuries are one of the most complicated injuries in modern orthopaedics. Their management requires a multidisciplinary approach by the surgeons. By comparing Stoppas and Ilioinguinal approach for the anterior acetabular fractures we can analyse which of the two approaches achieves better results in terms of anatomical reduction, better functional outcomes and less complications.

Keywords: Acetabular fractures, functional outcomes.

Sahil Sahota

(Signature) Candidate

(Signature) Co-supervisor

(Signature) Supervisor

(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH"** exist in the Department of Orthopaedics, DMC&H, Ludhiana and will be provided to be candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

Supervisor

Dr. Rajnish Garg
Professor & Head
Department of Orthopaedics
DMCH, Ludhiana

Co-Supervisor

Dr. Shekhar Singhal
Associate Professor
Department of Orthopaedics
DMCH, Ludhiana

HEAD OF DEPARTMENT

Dr. Rajnish Garg
Professor and Head
Department of Orthopaedics
DMCH, Ludhiana

Place: _____

Date: _____

APPROVAL PROFORMA
BY RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	DR. Sahil Sahota
Department	ORTHOPAEDICS
Topic of Thesis	TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH
Likely date of appearing in PG examination	MAY 2023
Date of enrollment	30 JUNE 2020
Name of Head of Department	Dr. Rajnish Garg
1) Supervisor **2) Co-Supervisor**	1) Dr. Rajnish Garg 2) Dr. Shekhar Singhal
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR. SAHIL SAHOTA S/O DRGULZAR MOHAMMAD SAHOTA ADDRESS- H.NO -214,GULZAR HOUSE DEFENCE COLONY, MALERKOTLA - 148023
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL , LUDHIANA
3	COURSE OF STUDY AND SUBJECT	MASTER OF SURGERY ORTHOPAEDICS
4	DATE OF ADMISSION OF COURSE	30 JUNE 2020
5	TITLE OF THE TOPIC	TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Acetabulum fractures are among the most serious injuries treated by orthopedic surgeons. Injury to the acetabulum is almost always associated with soft tissues, neurovascular as well as abdominal viscera, urinary bladder and urethral injuries. These complex injuries need multidisciplinary approach for the management in the tertiary health care centres. There is bimodal distribution of acetabulum injuries. In young population high energy trauma is the main cause of pelvic injuries whereas in age above 35 osteoporosis is one of the main cause of acetabular injuries. The result of the fixation is dependent on many variables such as extent of energy level of injury, radiographic fracture pattern, surgeons knowledge of pelvic anatomy, timing of surgery and appropriate choice of surgical approach.[1] Nowdays, although minimal invasive surgery has been popularized with the optimization of anatomic reduction and stability, the aim of the approach to be selected is to reduce morbidity.[2]

The acetabulum is made up of

1. Anterior column
2. Posterior column
3. Anterior wall
4. Posterior wall
5. Medial wall
6. Acetabular dome

Radiographically, there are six important landmarks in anteroposterior views

1. Iliopubic line
2. Ilioischial line
3. Teardrop sign
4. Anterior lip
5. Posterior lip

The acetabulum can be described as an incomplete hemisphere socket with an inverted horseshoe shaped articular surface surrounding the non articularcotyloid fossa. This articular surface is composed of and

supported by two columns of bone described by letournel and judet as inverted y shaped. The anterior column is composed of anterior half of iliac crest, iliac spines and anterior half of acetabulum.The posterior column is the ischium, ischial spines and posterior half of the acetabulum .The dome of the acetabulum is the weight bearing portion of the articular surface and supports the femoral head .The quadrilateral surface is the flat plate of bone forming the lateral border of the true pelvic cavity and thus lying adjacent to the medial wall of the acetabulum **.**The acetabulum is evaluated radiographically with an anteroposterior pelvic (AP) view as well as 45 degrees oblique views described by Judet and Letournel

CLASSIFICATION

Letournel and judet is the commonly used classification for acetabular fractures.[3]

The classification has 10 distinct categories which are devided into five elementary types and five associated types

Elementary (simple)patterns

- Anterior wall fractures
- Anterior column fractures
- Transverse fractures
- Posterior column fractures
- Posterior wall fractures

Associated (complex)fractures

- Both column fractures
- Anterior column / wall or posterior hemitransverse fractures
- T shaped fractures
- Transverse and posterior wall fractures
- Posterior column and posterior wall fractures

The two surgical approaches used for the anterior acetabulum fractures are:

1. Anterior ilioinguinal Approach –

This approach was developed by Emile Letournel in 196.[4] Patient was placed on radiolucent operating table in supine position. Skin incision was placed in midline 2 fingerbreadths above thesymphysis pubis, extended to the anterior superior iliac spine(ASIS) and then continued posteriorly along the line of the iliac crest. The aponeurosis of the external oblique was incised in line with the skin incision. An incision was carefully made along the inguinal ligament from its medial attachment to the pubis to the anterior superior iliac spine along its fibers. Three windows were created for visualization. The first window was formed by medial retraction of the iliopsoas and femoral nerves allowing visualization of the entire internal iliac fossa, the sacroiliac joint, and the pelvic brim. After mobilizing the iliopsoas muscle, Iliopectineal fascia was palpated and its medial and lateral surfaces was defined before its division. Blunt dissection was continued below the vessels. The second window was created by lateral retraction of the iliopsoas and femoral nerve, combined with medial retraction of the external iliac vessels and third window by lateral retraction of the vessels.The disadvatages of this approach is more time consuming, less likely blood loss,imposing less danger to external iliac vessels

2. Stoppas approach – This approach was first described by Rene Stoppa in the year 1975[5]

The patient is positioned supine on a radiolucent table. A transverse incision is made approximately 2 cm above the symphysis .This is carried short of each external inguinal ring. for the "lateral window", an incision is made along the iliac crest, starting 2 cm posterior to the ASIS, following the iliac crest posteriorly. Subcutaneous tissue and rectus fascia are incised transversely .The pyrimidalis muscle is released and tagged for later repair.The rectus abdominus fascia is split along the lineaalba. The transversalis fascia is opened superior to the pubic symphysis. This opens the potential space of retzius. For the lateral window, the insertion of the external oblique is

released,permitting dissection into the internal iliac crest fossa (requires elevation of the iliacus muscle.The origin of the rectus abdominus muscle is released off the posterior pubic rami but maintained anteriorly. A hohmann retractor is used to retract the rectus anteriorly. The iliopectineal fascia is released to enter the true pelvis. Anastamosis between the external iliac and obturator vessels (coronamortis) should be identified along the superior pubic ramus and ligated. The iliopsoas can now be subperiosteally elevated, and a retractor is used to retract the iliopsoas and external iliac vessels. The advantages are this approach is less time consuming, better surgical exposure, less blood loss, low risk of injuring the external iliac blood vessels. The complications of stoppas approach are neurovascular injuriy, infections, more blood loss as compared to anterior ilioinguinal approach. Hirvensalo et al described the Modified Stoppas Approach involving an anterior intrapelvic approach. The Modified Stoppas Approach provides better exposure of the quadilateral surface and posterior column. The dissection of the middle window is avoided in this approach, resulting in minimal dissection of the inguinal canal, femoral nerve and external iliac vessels.

6.2 REVIEW OF LITERATURE

Adawy et al[6] in the year 2017 studied Modified Stoppas Approach as a surgical alternative for fixation of anterior fracture of acetabulum. A randomized controlled clinical trial was conducted to provide an update of a favourable surgical approach in anterior acetabulum fractures .Two groups were compared regarding operative data and post operative data, complications and follow up. The results were – Group A those operated with Ilioinguinal approach and Group B those operated using Stoppas approach . The whole study included 25 Males (66%);mean age was 41.8±8.42 (range 18-65). The mean follow up was 18.5 months with 5 patients lost to follow up. Both column fractures were observed in most of the patients (45%). The observed results were based on Anatomical reduction, Surgical time, Blood loss. Quality of reduction was estimated on Antero Posterior (AP) and judet views immediately after the surgery evaluated by Matta criteria.[7]

RESULT MATTA CRITERIA	A*	%	B*	%
ANATOMICAL (0-1MM DISPLACEMENT)	9	50	15	75
IMPERFECT (2-3 MM DISPLACEMENT)	6	33	3	15
POOR (< 3 MM DISPLACEMT)	3	17	2	10
TOTAL	18	100	20	100

Surgical time in the study ranged from 80 – 256 mins. The mean operative time of the study in Group A was 211.14 ± 25 mins , which was longer as compared to Group B (116.15±21.6 mins).Mean blood loss was (856.4± 194.2 ml) in Group A and the need for intraoperative tansfusion was 100% in Group A while less in Group B (335±115.4 ml). He concluded in his study that the Modified Stoppa approach is the most convenient approach when surgery is required in the treatment of anterior acetabular fractures because it improves visualization in lateral

compression injuries and allows treatment of both column fractures with single incision. Hence, it is recommended as an alternative to Ilioinguinal approach. There is a higher rate of anatomical reduction in lesser surgical time and comparable complication rate with Stoppas approach compared to Ilioinguinal approach.[8]

Meena et al[9] in the year 2016 et al studied Modified Stoppas approach as an alternative to Ilioinguinal approach in management of anterior acetabular fractures .The method used was 375 patients were studied out of which 192 were managed with Ilioinguinal approach and 183 were managed with Stoppas approach .Anatomical reduction was compared according to Mattas criteria and it was found to be comparatively higher in Stoppas group. The complication rate was comparatively higher in the Ilioinguinal approach as compared to the Stoppas group. No significant differences were found between the two groups in term of functional outcome. His metanalysis was conducted according to the guidelines of the preferred reporting itemns for systemic reviews and meta analysis (PRISMA) and also the cochrane handbook of systemic reviews of intervention.[10]

Initially, Rives et al and Stoppa et al used the modified stoppas approach for the inguinal hernia surgery. Cole and Bolhofner and Hirvensaloet al. described it as a method to approach the anterior acetabulum and pelvic bone.[11-14]

Elmadag et al[15] in the year 2014 studied that Stoppas approach allows less blood loss than the Ilioinguinal approach in the management of anterior column of acetabulum fractures. In his study , 19 patients who were treated with Ilioinguinal approach (group A) at a mean follow up of 33 months and 17 patients who were treated with Modified Stoppas approach (group B) at a mean follow up of 28.9 months were retrospectively reviewed . Patients were followed up and functional evaluation was done with measuring the range of motion , Harris Hip Score(HHS), Merle de Aubigne Score. Average blood loss was determined at a mean 1170 mL (range, 750–2150 mL) in Group A and at a mean 1110 mL (range, 450–2000 mL) in Group B (P = 0.168). At the final follow-up, the mean hipflexion was found to be 106.83 ±

12.47 degrees and the hip extension was 10.33 ± 6.12 in Group A, while these values were 103.71 ± 14.32 and 10.69 ± 8.17 in Group B.

Yao et al[16] in the year 2017 studied to compare the efficacy of the operative techniques ,complications, reduction quality and hip functional recovery by using the Suprainguinal approach and the Modified Stoppas approach for the management of acetabular fractures . The methods used were - a consecutive cohort of 60 patients from september 2014 to october 2017 with displaced acetabular fractures involving acetabularfracturess involving the quadrilateral plate were treated operatively with Suprainguinal approach (Group A) and Modified Stoppas Approach (Group B)respectively. There were 36 patients in group a and 24 patients in Group B. The surgical details, complications, radiographic and clinical results were recorded. The quality of reduction was assesed by measuring the residual step and gap displacement in post operative CT. The final conclusions were compared to Stoppas approach, the Supra Ilioinguinal approach provides a closer visualisation to the quadrilateral plate, the operative time was shorter and intra operative hemorrhage was clearly less.

Ram ji et al[17] in the year 2017 studied the functional outcomes of surgically treated acetabular fractures. He conducted a prospective study of a total number of 46 patients with the diagnosis of acetabularfractures . The outcomes of the patients wasassesed on the basis of functional and radiological outcomes using Harris Hip Score. The results were excellent in 60.86% , good in 21.73%, fair in 8.69% and poor in 8.69% patients.

Kadam et al[18] in the year 2018 analyzed the clinical and functional outcome of acetabular fracture treated by Modified Stoppa Approach. He analysed intraoperative and post-complications of fractures treated by the Modified Stoppa Approach. A total of 20 patients who needed the anterior approach for the treatment of acetabular fracture from May 2016 to May 2018, were subjected to surgery via Modified Stoppa Approach. Pre-operative anterior posterior (AP) view and Judet view and CTscan were done to classify the fracture. Functional outcome

was assessed by using the Modified Merle d' AubignePostel clinical grading system. The results were excellent in 12 cases, very good 2 in cases and good in 1 cases, fair in 1 case and poor in 4 cases. Although the radiological 12 cases had anatomical reduction, 5 imperfect reduction and 3 poor reduction. It can be concluded that the Modified Stoppa Approach could be used as an alternative to the Ilioinguinal approach. It's provides excellent access and visualization to the anterior column and quadrilateral surface and the rates of complication were less as compare to Ilioinguinal approach.

Khoury et al[19] in his study analysed the use of the Stoppa approach, its indications, preparations, the detailed surgical approach, complications and the different tips used in this relatively modern approach. The results were In a 5-year review of 60 acetabular fractures that underwent open reduction and internal fixation using the Modified Stoppas Approach, there were 36% anterior column fractures, 28% both-column fractures, the rest being anterior column with posterior hemi transverse fractures, transverse and T-fractures. Any extension of the fracture to the iliac wing necessitated an additional lateral window (93% of cases). In cases with posterior displacement, an additional approach was utilized to address a posterior wall fracture. All fractures healed within 12 weeks. Mean Merle d'Aubigné score was 15.22. Postoperative radiological evaluation revealed anatomical reduction in 54% of the patients, satisfactory in 43%, and unsatisfactory in 3% of the patients. Overall there were 15 minor and major complications.

Aziz et al[20] in 2020 studied advantages and disadvantages of Modified Stoppa Approach (MSA) and Ilioinguinal approach (IIA) for surgery of pelviacetabular fractures involving anterior column, anterior wall, quadrilateral plate with protrusion and complex fractures, pelvic ring fractures with pubic diastasis or sacroiliac joint disruptions which needs to be stabilized anteriorly. The study was conducted on patients with pelviacetabular fractures. In the study of 25 patients, they were divided into group A containing 13 patients operated using MSA and group B containing 12 patients operated using IIA. Follow up period

was 12-18 months (mean=15) and 12-16 months (mean=14) for group A and B, respectively. Patients assessed using modified Merle d'Aubigné score and Matta's score. The results were based on Mean modified Merle d'Aubigné score was 16 and 14 for Group A and B, respectively (p value=0.89). Mean blood loss and operative time were less in MSA. Superficial infection was found in one patient each of Group A and B whereas one patient developed deep infection in Group B. One patient each of both group had hip pain suggestive of early Arthrosis. In Group B, two patients developed MeralgiaParesthetica. One patient developed external iliac artery thrombosis and inguinal hernia in Group B. One patient from Group A developed incisional hernia. Conclusions: MSA was better and simpler than IIA with due adequate training and practice to achieve direct access for pelviacetabular fracture reduction and also it requires less operative time, less blood loss and better postoperative outcome.

Kunlong et al [21] also showed no significant difference between the two groups in terms of all complications

Taller et al [22] in his study analysed the risk of injury to femoral cutaneous nerve in Stoppas and Ilioinguinal approach and concluded that Stoppas approach was more minimally invasive to the femoral cutaneous nerve than the Ilioinguinal approach.

6.3 AIMS & OBJECTIVE OF THE STUDY

To evaluate and compare Stoppas and Ilioinguinal approach for anterior acetabulum fractures in terms of

- Anatomical reduction
- Complications
- Functional outcomes

7. MATERIALS AND METHOD

7.1 SOURCE OF DATA

Patients included in the study were admitted in Department of Orthopedics in Dayanand Medical College & Hospital, Ludhiana from January 2019 to January 2023 who had given informed consent to take part in the study

7.2 METHOD OF COLLECTION OF DATA

A. Methodology and type of data collected:

After obtaining clearance and approval from the institutional ethical committee, patients fulfilling the inclusion / exclusion criteria were included in the study after obtaining informed consent. Detailed history was obtained using study proforma with special attention to mechanism of injury, evaluations including base line clinical features, examination of other associated symptoms was based on history and physical examination. Collection of data of patients presenting with anterior column fracture of acetabulum are as follows.

- history.
- clinical examination both systemic and local.
- radiological examination using x ray, CT (computerized tomography)scan and other imaging modalities if necessary.
- investigations – routine and others.
- diagnosis- clinical and radiological.
- surgery- open reduction and internal fixation of anterior column fracture ofacetabulum.
- routine antibiotics and analgesics/anti-inflammatory drugs.
- dvt prophylaxis
- post operative evaluation by clinical examination and x ray pelvis (apview, iliac oblique view, obturator oblique view)

Surgical approaches:

- Ilioinguinal approach
- Stoppa’s approach

Assessment of complications.

• Perioperative–difficulty in reduction, hypotension, shock,hemorrhage, nerve injury, vascular injury, inability to reduce the hip.

• Immediate Post-operative –acute renal failure (arf), pulmonaryembolism, fat embolism, cardiovascular compromise ,infection, loss of reduction, dvt

• Late Post-operative -infection, nonunion, malunion, failed fixation,osteoarthritis of hip joint, avascular necrosis of the femoral head,dislocation of femoral head, metal work failure

Clinical follow-up was done at 4 weeks, 3 months, 6 months intervals to assess the pain, healing of fracture, and functional status of the hip.

Radiological follow up by X ray was done at 4 weeks, 3 months, 6months, to assess the reduction and healing status of the hip.

INCLUSION CRITERIA:

1. Anterior column fractures of acetabulum
2. Age group >18 years of either gender.
3. Patients who give informed consent and willing for follow up.

EXCLUSION CRITERIA:

1. Patients less than 18 years of age.
2. Patients unfit for surgery.
3. Pregnant patients
4. Open fractures
5. Pathological fractures
6. Patients managed conservatively
7. Patients managed with hip replacement

Study design: prospective & retrospective

Study duration: 3 years

Place of study: In patients in Department Of Orthopedics in Dayanand Medical College & Hospital, Ludhiana.

Pre- operative regimen:

A detailed history was taken from the patient presenting to the hospital Emergency department.Assessment of airway. Breathing and Circulation was done first and managed accordingly. Patient underwent complete physical examination to evaluate the extent of injuries and

neurovascular status. Analgesics, blood products and i/v fluids were administered as per requirement. Patient was resuscitated and routineinvestigations and radiographs were done. Any co-existing comorbidities such as diabetes mellitus, smoking, hypertension etc. were evaluated accordingly. Pre anesthetic consultation was taken and the patient was planned for surgery when fit.

Post- operative regimen:

Post-operative x-rays were done to check the reduction and fixation of fracture. Skeletal/skin traction was applied if deemed necessary by the operating surgeon. Patient underwent appropriate physiotherapy as tolerated. I/v antibiotics and analgesics were continued as per Protocol. Appropriate dvt prophylaxis was given. After discharge fromthe hospital, the patient was called for regular follow up for dressingand repeat radiographs and for assessing the functional status of hip.

Weight bearing was allowed according to the radiological and clinicalresults. The patients were analyzed for complications such as infection, limb shortening, deformity at the joint, implant failure, nonunion, delayed union, post traumatic arthritis, heterotopic ossification etc

NO OF CASES – Cases gathered in the given time period of thesis study.

OUTCOME -The stoppas and the Ilioinguinal approach will be compared in terms of anatomical reduction, complications and functional outcomes and conclusion will be made regarding which of the following two surgical approaches is better for anterior acetabular fractures.

STATISTICAL ANALYSIS:

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups will be done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and exact test was used when the

expected frequency is less than 5. A probability value (p value)less than 0.05 will be considered statistically significant. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

8. LIST OF REFERENCES

1. Anizar-Faizi A, Hisam A, SudhagarKP, Moganadass M, Suresh C. Outcome of surgical treatment for displaced acetabular fractures. Malaysian orthopaedic journal. 2014;8:1.
2. Keel MJ, Ecker TM, Siebenrock KA, Bastian JD. Rationales for the Bernese approaches in acetabular surgery. Eur J TraumaEmerg Surg. 2012;38:489-98.
3. Judet R, Judet J, Letournel E. Fractures of the acetabulum: Classification and surgical approaches. J Bone Joint Surg Am. 1964;46(A):1615-46.
4. Letournel E. Fractures of the acetabulum. A study of a series of 75 cases. 1961. ClinOrthopRelat Res. 1994;305:5-9.
5. Stoppa RE, Rives JL, Warlaumont CR, Palot JP, VerhaeghePJ, DelattreJF. The use of Dacron in the repair of hernias of the groin. SurgClin North Am. 1984;64:269–85.
6. 6-Al Adawy AS, Aziz AHA, El Sherief FA, Mahmoud WS, Mabrook M, Hassan YE. Modified Stoppa as an alternative surgical approach for fixation of anterior fracture acetabulum: a randomized control clinical trial. *J OrthopSurg Res*. 2020;15:154.
7. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury.J Bone Joint Surg Am. 1996;78:1632–45.
8. Shazar N, Eshed I, Ackshota N, Hershkovich O, Khazanov A, Herman A.Comparison of acetabular fracture reduction quality by the ilioinguinalorthe anterior intrapelvic (modified Rives-Stoppa) surgical approaches. JOrthop Trauma. 2014;28:313–9.
9. Meena S, Sharma PK, Mittal S, Sharma J, Chowdhury B. Modified Stoppa Approach versus Ilioinguinal Approach for Anterior Acetabular Fractures; A Systematic Review and Meta-Analysis. Bull Emerg Trauma. 2017;5:6-12.
10. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int J Surg. 2010;8:336–41.

11. Rives J, Stoppa R, Fortesa L, Nicaise H. Dacron patches and their place insurgery of groin hernia: 65 cases collected from a complete series of 274hernia operations. Ann Chir. 1968;22:159–71.
12. Stoppa RE, Rives JL, Warlaumont CR, Palot JP, VerhaeghePJ, DelattreJF. Theuse of Dacron in the repair of hernias of the groin. SurgClin North Am.1984;64:269–85.
13. Cole JD, Bolhofner BR. Acetabular fracture fixation via a modified Stoppalimited intrapelvic approach: description of operative technique andpreliminary treatment results. ClinOrthopRelat Res. 1994;305:112–23.
14. Hirvensalo E, Lindahl J, Bostman O. A new approach to the internal fixationof unstable pelvic fractures. ClinOrthopRelat Res. 1993;297:28–32.
15. Elmadağ M, Güzel Y, Acar MA, UzerGÖ, Arazi M. The Stoppa approach versus the ilioinguinal approach for anterior acetabular fractures: a case control study assessing blood loss complications and function outcomes. Orthopaedics & Traumatology: Surgery & Research. 2014;100:675-80.
16. Yao S, Chen K, Ji Y, Zhu F, Zeng L, Xiong Z, et al. Supra-ilioinguinal versus modified Stoppa approach in the treatment of acetabular fractures: reduction quality and early clinical results of a retrospective study. Journal of orthopaedic surgery and research. 2019;14:1-9.
17. Lal SR. Outcome of surgical treatment for displaced acetabular fractures: a prospective study. Rev Bras Ortop. 2017;53:482-8.
18. Kadam R, Dagar PS, Challani A, Jadhav A, Pestonji J. Functional outcome of acetabular fracture fixation by modified Stoppas approach. Int J Res Orthop. 2019;5:177-81
19. Khoury A, Weill Y, Mosheiff R. The Stoppa approach for acetabular fracture. Operative Orthopädie und Traumatologie. 2012;24:439-48.

20. Aziz AMA, Sonkawade VD, Santpure S. Comparative study of modified Stoppa approach and ilioinguinal approach for pelviacetabular fractures. Int J Res Orthop. 2020;6:1070-6.
21. Ma K, Luan F, Wang X, Ao Y, Liang Y, Fang Y, et al. Randomized, controlled trial of the modified Stoppa versus the ilioinguinal approach for acetabular fractures. Orthopedics. 2013;36:e1307-15.
22. Taller S, Srám J, Lukás R, Krivohlávek M. Surgical treatment of pelvic ring and acetabular fractures using the Stoppa approach. ActachirurgiaeorthopaedicaeettraumatologiaeCechoslovaca. 2010;77:93-8.

PROFORMA

S.NO

NAME

AGE/ SEX

MRD NO

ADMISSION NO

DATE OF ADMISSION

DATE OF DISCHARGE

RELIGION

OCCUPATION

DATE OF INJURY

MODE OF INJURY: ROAD SIDE ACCIDENT / MOTOR VEHICLE ACCIDENT

EMPLOYMENT STATUS - WORKING / NOT WORKING

LOCAL EXAMINATION -

- OPEN / CLOSED FRACTURE
- XRAY FINDING

FRACTURE CLASSIFICATION
SITE OF FRACTURE
HIP DISLOCATION

Signature of Candidate **Signature of Supervisor**

OPERATION / PROCEDURE

ANAESTHESIA USED- GENERAL ANAESTHESIA/ SPINAL ANAETHESIA

DATE OF SURGERY

SURGICAL APPROACH USED

IMPLANT TYPE – INDIAN/ IMPORTED

TIME OF SURGERY

LESS THAN 1 HOUR	
1-2 HRS	
> 2 HRS	

BLOOD LOSS-

<500 ML	
500-1000ML	
1000-1500 ML	
> 1500 ML	

COMPLICATIONS-

- INTRA OPERATIVE
- POST OPERATIVE
- DELAYED

Signature of Candidate

Signature of Supervisor

FOLLOW UP-

- RADIOLOGICAL UNION –

ANATOMICAL REDUCTION	4 WEEKS	3 MONTHS	6 MONTHS
<1MM DISPLACEMENT			
2-3 MM DISPLACEMENT			
>3MM DISPLACEMENT			

Follow up by Merle d' Aubigne and Postel Method

Parameters	4 weeks	3 months	6 months
Mobility of the hip			
Pain			
Ability to walk			

Signature of Candidate **Signature of Supervisor**

CRITERIA FOR FUNCTIONAL EVALUATION

Merle d' Aubigne and Postel Method

SCORE	PAIN	MOBILITY	ABILITY TO WALK
0	Pain is intense and permanent	Ankylosis in abnormal position	Impossible
1	Pain is severe, disturbing sleep	Ankylosis in normal position or in a very slight abnormal position	Only with crutches
2	Pain is severe when walking , prevents any activity	Flexion <40 degrees(abduction =0 degrees)or a very light joint deformity	Only with two canes
3	Pain is severe but may be tolerated with limited activity	Flexion <40- 60 degees	Limited with one cane (less than 1 hour). Very difficult without a cane
4	Pain only after walking and dissapearing with rest	Flexion > 60 -80 degrees (can tie shoelaces)	Prolonged with one cane , limited without cane (limp)
5	Very little pain and intermittent and does not preclude normal activity	Flexion >80- 90 degrees Limited abduction (>25degrees)	Without a cane but slight limp
6	No pain at all	Normal flexion >90 degrees , Abduction>25 degrees	Normal

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

.....am willing to participate in the study **"TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य "TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"TO STUDY THE OUTCOME OF ANTERIOR ACETABULUM FRACTURES USING STOPPAS AND ILIOINGUINAL APPROACH" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____
ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

_____
ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

_____
ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____
ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ